JANUARY 1955

pmm

including DIE CASTINGS magazine

precision metal molding

devoted exclusively to...

DIE CASTINGS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

IN THIS ISSUE:

Permanent Mold or Semi Permanent— which is better for your casting?

See complete table of contents on page 3

Aluminum or Zinc Alloys

that always help you get better quality castings and trouble-free production

Aluminum ALLOYS

- All ingot produced for die casting, permanent mold and sand casting requirements have superior working characteristics and are free from impurities and gas.
- Composition is constantly checked during production to assure ingot meets your specifications.
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- All alloys to your specifications.
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- Deliveries are promptly made to meet your production schedule.

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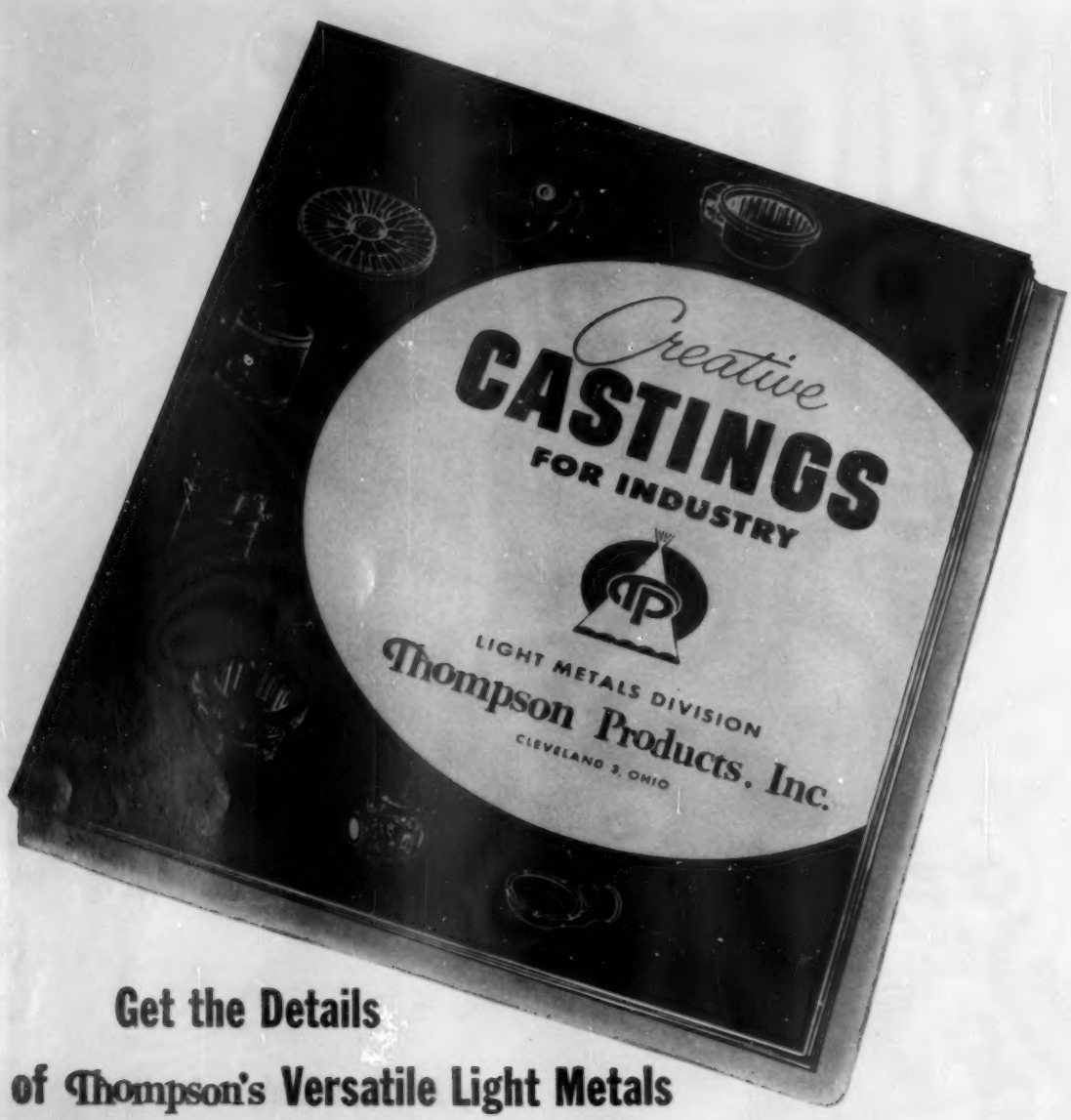

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IF you use castings, you'll want this booklet which describes the versatile foundry facilities available to you at Thompson Products' Light Metals Division.

Over 50 years experience in research and manufacture of precision metal parts enables Thompson today to offer its facilities to all types of industry.

This booklet details the entire light metals operation at Thompson and features some of the many parts precision-engineered by Thompson for such diversified customer uses as airplanes and washing machines; buses and garbage disposers; tractors and outboard motors; automobiles and industrial engines. It describes, too, some of the many research and manufacturing pluses used by Thompson to insure you of quality parts, delivered when you want them.

Fill in this coupon and mail today for your free copy:

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Please send me a copy of your booklet, "Creative Castings"

Name_____

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Company_____

Address_____

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pmm

January 1955

Volume 13 Number 1

precision metal molding

DIE CASTINGS
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PLASTER MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
SHELL MOLD CASTINGS

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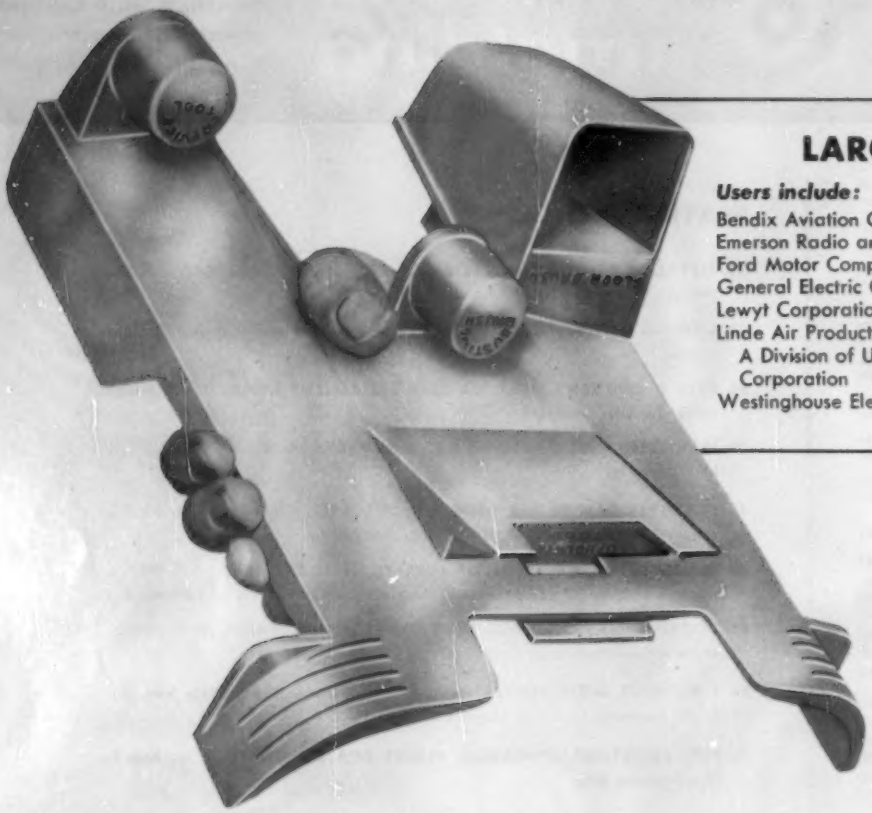
Many Leading Manufacturers Specify

DOLLIN ZINC AND ALUMINUM DIE-CASTINGS



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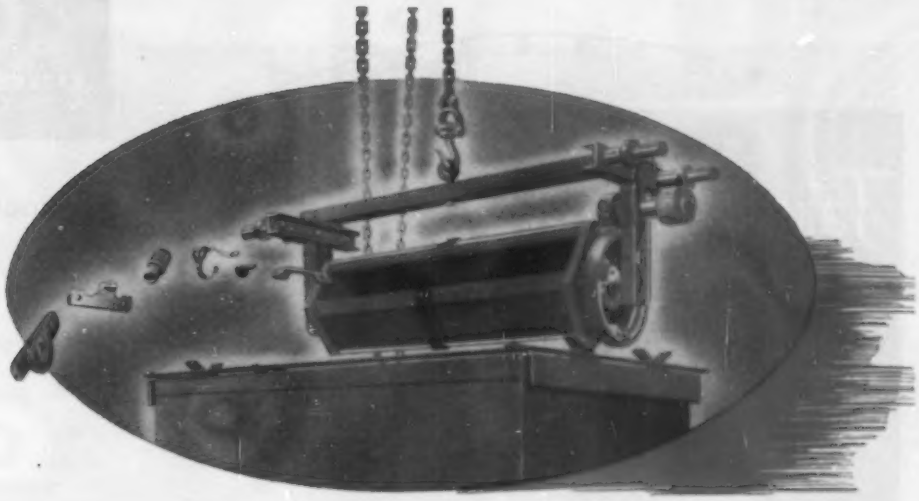

Plating on Aluminum made EASY with Alumon*

Hundreds of manufacturers throughout the United States are now using electroplated aluminum. The Alumon process is simple. The work is merely cleaned, dipped in acid, dipped in Alumon and is then ready for electroplating with copper, nickel, and other metals. The process is suitable for plating most wrought and cast alloys. . . The cost of using Alumon is low, being less than half a cent per square foot of surface area treated. The process can be fitted easily into regular plating cycles. Bulk or barrel plating readily done. Upon request we'll gladly send you the Alumon Process Bulletin.

Write for literature on Alumon and check list of literature on sixty Enthone products and processes for better metal finishing.

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MH Chrome-Nickel Pre-Alloyed Powders

can give your compact, regardless of size —

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Yes, a 7.5% addition of Metal Hydrides' pre-alloyed chromium-nickel powder, plus 1% graphite to electrolytic iron powder can give your product these qualities. Check the chart below. See how easily MH chrome-nickel pre-alloyed powder can fit into your production picture, giving you volume production of high tensile, intricate parts at less cost:

	No Alloy		7.5% (20 Cr-80 Ni)		7.5% (30 Cr-70 Ni)		7.5% (80 Cr-20 Ni)	
	2012°F	2192°F	2012°F	2192°	2012°F	2192°F	2012°F	2192°F
Density, g/cc	7.05	7.12	7.02	7.11	6.95	7.10	6.74	6.63
Rockwell Hardness	B-78	B-78	B-71	B-90	B-91	B-90	B-80	B-98
Tensile Strength, psi	53000	68500	70200	83000	82700	100800	73600	105000
Elongation, % in 1"	4.2	4.0	4.9	3.4	2.7	4.6	1.8	2.2

Write for complete information now. No obligation of course.

MH

Metal Hydrides
INCORPORATED

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SOURCES FOR DIE CASTINGS

We are interested in hearing from zinc die casters throughout the country, and thought perhaps you might give this matter a little publicity.

We would like sketches or samples of various items that the zinc die casters might supply from their own dies or from those under their control. The pieces we are interested in could be household, premium or gift items which would lend themselves principally to chrome plating. As an example, it could be ash trays, candle sticks, wall plaques, etc.

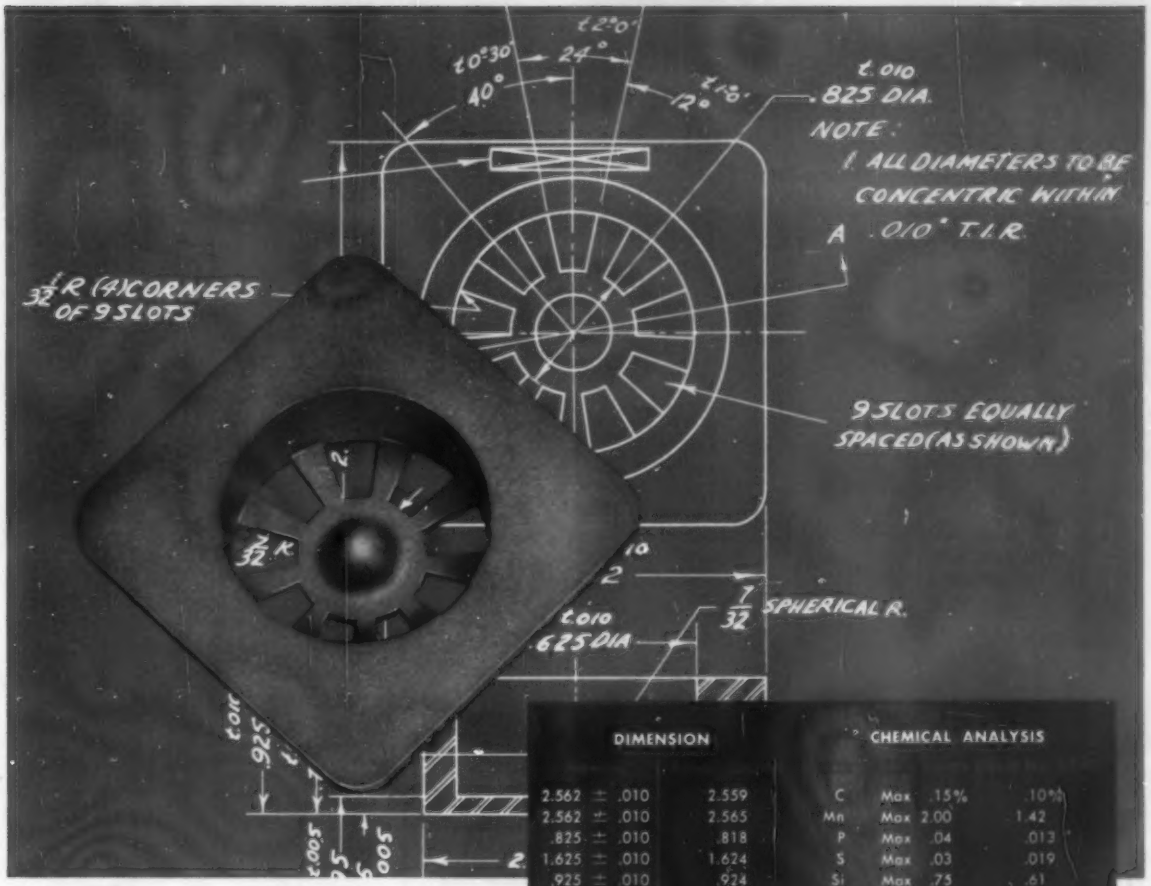
We would like sketches, samples, full information and quotations of die cast pieces fully machined where required, and ready for plating. Quotations may be made on 100—500—1000—5000—10,000 and 25,000 lots.

This request may appear as rather unusual. On the other hand, a great many die casters have old and new dies lying around which could possibly be put to use and a chance of volume of sales made on the items they can furnish.—M.J.G.

We are looking for a source of small stock die cast pinions, racks and spur gears. We have been unable to locate such a source. If you have this information, please give us the names of suppliers. — R.J.L. (Engineer)

The writer of this letter is looking for manufacturers of Die Cast or Permanent Moulded silhouette type or regular ornaments, approximate size 6" x 6", for house markers. Would you please be kind enough to send me all particulars with addresses? — A.K.

Continued on page 8



DIMENSION			CHEMICAL ANALYSIS		
2.562 ± .010		2.559	C	Max .15%	.10%
2.562 ± .010		2.565	Mn	Max 2.00	1.42
.825 ± .010		.818	P	Max .04	.013
1.625 ± .010		1.624	S	Max .03	.019
.925 ± .010		.924	Si	Max .75	.61
.700 ± .010		.698	Ni	12.00-14.00	13.00
.105 ± .005		.109	Cr	16.00-18.00	17.70
2.050 ± .010		2.058	Cu	Max .50	.07
.295 ± .005		.293	Mo	1.50-2.25	1.96

Rely on

Crucible ACCUMET investment castings

for dimensional and metallurgical accuracy . . .

This intricately shaped aircraft instrument part had to be held to rigid specifications both in size and in chemical analysis of the steel.

That's why Crucible ACCUMET® precision castings were used. For Crucible's *lost wax* method of casting, and its long experience as the country's leading producer of fine special purpose steels, combine to bring you accurate castings of the highest quality. But the two tables shown below actually tell the story better than words can. They show how closely ACCUMET castings are held to original specifications.

The next time you have a job where quality and close tolerances are needed, be sure to investigate the advantages of ACCUMET precision castings — *call Crucible.*

CRUCIBLE

first name in special purpose steels

54 years of Fine steelmaking **ACCUMET INVESTMENT CASTINGS**

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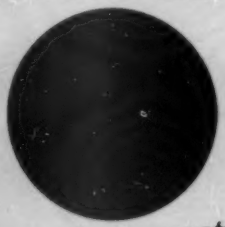

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The George Sall Metals Co., Inc.

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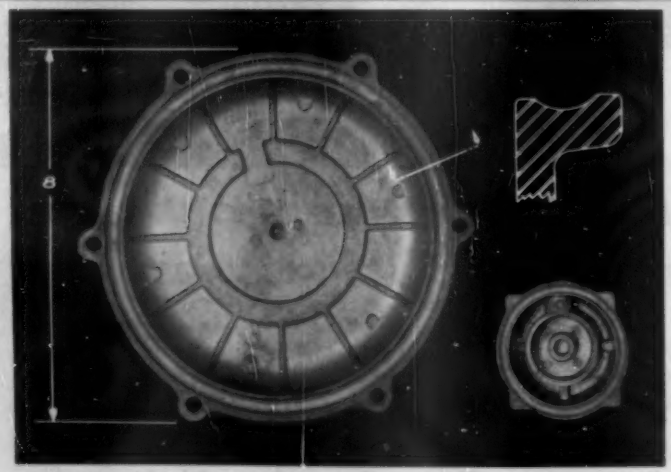
PRODUCERS OF: *Aluminum, Brass and Bronze, and Zinc Ingot; Hardeners, Z-shot and bar for Zamak production, Salloy, Special Alloys.*



Aluminum Die Castings tested at 90 psi are used successfully without impregnation.

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LETTERS TO THE EDITOR
continued from page 6

We will gladly forward any material, or supply names and addresses of the above inquirers to die casters who have dies available. However, we do not have a list of stock die casting dies. — Ed.

PLASTER MOLD CASTINGS

In the November issue of your magazine "PRECISION METAL MOLDING" there was an article by Mr. John Cowan, an engineer of the Sperry Products, Inc., dealing with plaster molds. I wonder if you could supply me with any information dealing with the making of such molds and where the plaster material used may be obtained.

Since our operations here are under strict security there are times when it is necessary for us to do things ourselves which under other rules would be contracted out to concerns having experience in that field.

We are now faced with such a situation and any information which you can supply on the above mentioned subject will be greatly appreciated.—J.C.C. (Equipment Designer).

The name of a company manufacturing a gypsum plaster specifically for casting non-ferrous metals has been forwarded. That company has complete, detailed instructions for making molds for casting metal. — Ed.

POWDERED ALUMINUM PARTS

We would appreciate very much having further information on parts made from powder metal. Our particular interest is in aluminum alloys and we would like to know if this process can be used to form aluminum alloy parts. — J.L.E. (Chief Engineer)

To the best of our knowledge, no commercial work has been done molding parts from aluminum powder in this country. Although experimental work has been done, it is not known whether any company is ready for production. — Ed.

HAMILTON ART METAL CORP. plans to use *LINDBERG-FISHER* melting furnaces exclusively

The Hamilton Art Metal Corporation, New Hyde Park, New York, has equipped five die casting machines with Lindberg-Fisher, 40 KW, two chamber induction melting and holding furnaces for aluminum. Each furnace was purchased, one by one, based on the excellent performance of previous units. Noted for the quality of its intricate castings, this job die casting plant has increased production 38% and cut rejects to the bone by using the Lindberg-Fisher principle of induction melting.

The term "satisfaction" would be a gross understatement as reflected in the words of Mr. Eric Wedemeyer, President, who says:

"I am making plans for the day when our plant will be 100% Lindberg-Fisher equipped. If it were not for local power limitations, we would immediately replace the fuel fired equipment we are forced to partially use in favor of additional induction equipment designed by Lindberg-Fisher. Improved operator working conditions have brought our personnel turnover to a stand-still.

In my opinion Lindberg-Fisher furnaces are head and shoulders above other methods of melting found in the field of die casting today."

You'll increase production. You'll reduce rejects. You'll improve working conditions. The famous Lindberg-Fisher 2-chamber construction does the trick.

Two-chamber construction gives you cleaner molten metal and permits continuous ladling. Cold metal can be added to the charging chamber without affecting temperature of ladling chamber. Scrap can be re-charged thereby eliminating handling and identification problems.

Two-chamber construction permits cooler working conditions. Induction heating heats only the metal, not the entire furnace. There are no flames—no products of combustion. Only a comparatively small area of molten metal is exposed to the operator.

Ask for a copy of bulletin 560 "Lindberg-Fisher two-chamber melting furnaces."

LINDBERG-FISHER MELTING FURNACES

Lindberg Engineering Company • 2463 West Hubbard Street • Chicago 21, Illinois

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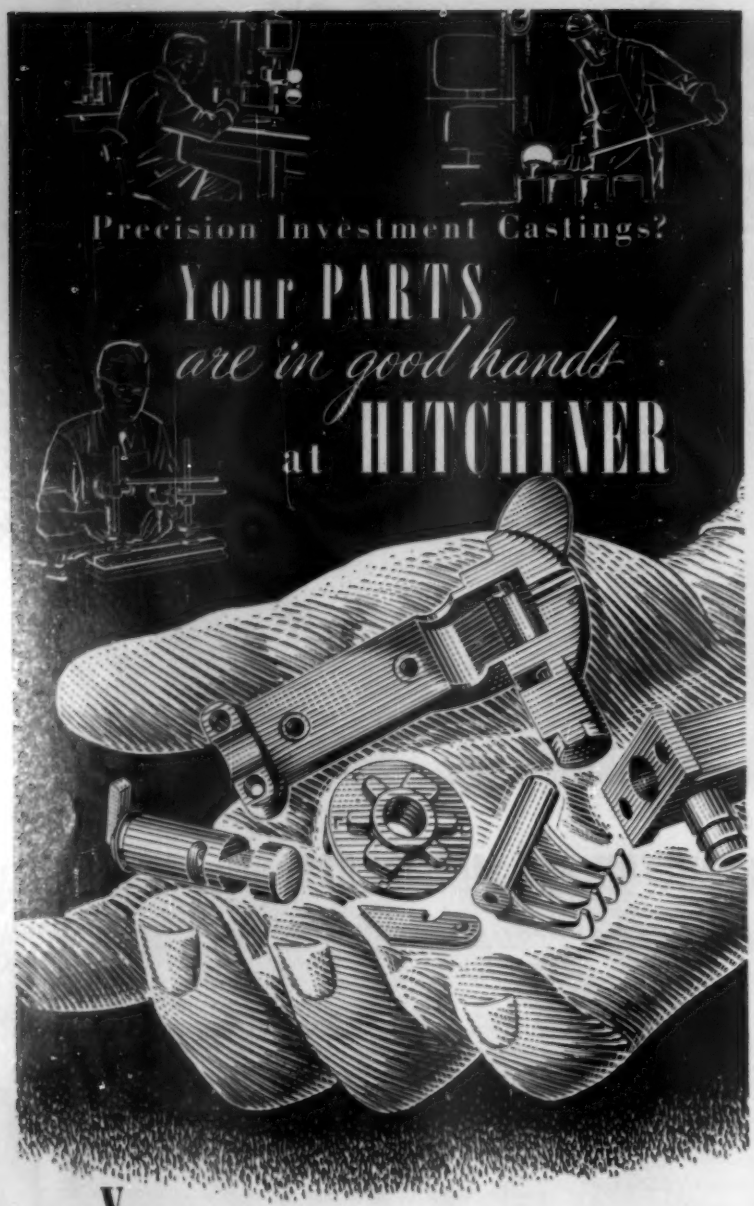

YES, Hitchiner's broad experience and complete facilities — exclusively devoted to producing precision investment castings — can be a profitable factor in the success of your product. The reason? From die shop to research and testing laboratories to heat treating department . . . every step in the fabricating of your component parts is under the direct supervision of top management and in the competent hands of Hitchiner craftsmen.

The booklet "INVESTMENT . . . For Economy . . . For Performance" gives complete information. Write for your copy or ask your nearest Hitchiner representative to call.

HITCHINER Manufacturing Company, Inc.

Precision Investment Castings

MILFORD 7, NEW HAMPSHIRE

REPRESENTATIVES IN PRINCIPAL CITIES

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MECHANICAL FAILURES OF METALS IN SERVICE, by John A. Bennett and G. Willard Quick, National Bureau of Standards Circular 550, 36 pages, 102 figures, 1 table, 30 cents. (Order from the Government Printing Office, Washington 25, D. C.)

For many years the National Bureau of Standards has been requested to examine metal parts that have failed in service for evidence bearing on the causes of these failures. The examinations have been undertaken at the request of other Government agencies such as the Civil Aeronautics Board, the Interstate Commerce Commission, and the Coast Guard.

This circular describes 35 such cases representing the most frequently observed types of failures. The factors of design, fabrication, or use contributing to these failures are presented. The characteristics by which the various types of fractures can be recognized are discussed, and recommended precautions that should be observed to reduce mechanical failures in service are included.

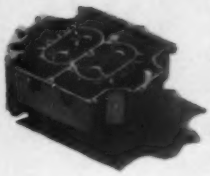
The volume is well illustrated with photographs of the failures discussed along with photomicrographs showing sources of failure.

A BEGINNER'S COURSE IN BASIC PNEUMATICS, published by The Industrial Publishing Group, 1240 Ontario St., Cleveland, Ohio; Price, $1.00 (Special discounts in quantities for company training programs).

"A Beginner's Course in Basic Pneumatics" is a concise, practical survey of the fundamentals of pneumatics as they apply to industrial equipment. Major attention has been given to components of modern pneumatic equipment, particularly, standard air cylinders, valves

Continued on page 28

PRECISION *Can Do all This in* DIE CASTING

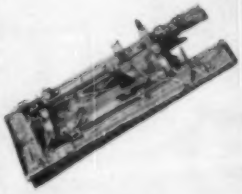


Complicated CASTINGS

LARGE CASTINGS

THIN WALL CASTINGS

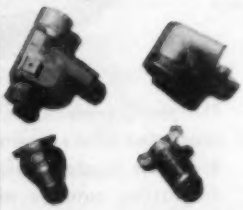
INSERTS IN CASTINGS



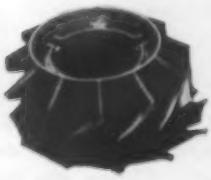
CLOSE TOLERANCE

FINISHED CASTINGS

EXTERNAL THREADS



FUNCTIONAL DIE CASTINGS



Call a PRECISION Engineer, Today!

*Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry

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British Affiliation — Wolverhampton Die Casting Co., Wolverhampton, England

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AJAXOMATIC* POURING UNIT

In Operation at Montrose Division,

BENDIX AVIATION CORPORATION

Photo shows installation of AJAXOMATIC Combined Holding Furnace and Automatic Pouring Unit in connection with die casting machine. In circle at right is shown a closer view of the spout from which uniform shots of molten aluminum alloy are ejected at exact time intervals by means of an electronic timer, which works with the accuracy of a lens shutter.

NOW completely automatic die casting of aluminum alloys is possible in smaller quantities than formerly, and at reduced cost. This fact should be of special interest to the manufacturer who has die casting machines in operation and is doing hand loading. The unit is entirely sealed, the operator feels no heat, accident hazard is eliminated.

This small, compact AJAXOMATIC* unit will increase production of die castings by as much as 25%, because it delivers regular, uniform quantities of metal into the die casting machine with no delay, immediately after dies are closed. The spout itself is heated and the temperature of each metal shot remains constant.

* Trade Mark, Registered

For further innformation send for descriptive folder G-3

AJAX

TAMA-WYATT

AJAX ENGINEERING CORP., TRENTON 7, N. J.

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

For more information circle No. 9 on the Reader Service Card

time tested designing with MADISON-KIPP zinc and aluminum die castings

The pumping unit is the most vital component in Madison-Kipp high pressure lubricators. The one here illustrated is used for pressures up to 2500 lbs.

Free use of iron and steel and brass inserts are features of many lubricator die castings as in the Aluminum Housing shown above.

The exacting service requirements of accurate measuring and forcing devices is something in which we have qualified as experts for nearly sixty years. Perhaps our time tested design formulas may be of help to you.

We will be pleased to review your blue prints.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information circle No. 44 on the Reader Service Card

Costly Work Stoppage Eliminated by EPCO

INVESTMENT CASTINGS

The part at left was composed of a machined stamping, two screw machine parts and a hardened steel bushing. The constant twisting and breakage of this fabricated part resulted in almost daily stoppage of the conveying system on which it was used.

By contrast, the part on the right, cast in *one piece* without further machining by EPCO Investment Casting, actually cost less and increased production. By making this important part from an air hardening tool steel, further heat treating was unnecessary, and a hardness of Rockwell "C" 53 to 55 was attained.

INVESTMENT CASTINGS IN ANY CASTABLE ALLOY EXCEPT MAGNESIUM

Send Us Your Drawings For Quotations On Parts Where EXTRA QUALITY Must Be Maintained.

EPCO ENGINEERED PRECISION CASTING CO.

Freehold Rd.,
Matawan, N. J.

Circle No. 25 on Reader Service Card

BETWEEN THE LINES

BULLDOZERS TO BUSINESS MACHINES. Friction materials produced from metal powders are doing an effective job in clutches, brakes, actuators, etc. Maybe a friction surface produced by powder metallurgy would do a better job than the material you are now using in your product. For an informative article on this type of friction material and its uses, turn to page 31.

PERFORMANCE PREDICTIONS? How much advance information can a designer get concerning the probable physical properties and performance of components produced by powder metallurgy or investment casting? Two papers to be presented in February relate to this important problem. A study of prototype powdered metal parts machined from blanks, and a research investigation comparing investment cast test bars with actual production castings, are scheduled for PMM's readers.

HOW'S YOUR HORSEPOWER? If you build gasoline engines, you'll be interested in a report on the way one company stepped-up its power output by 5 percent by changing to a die cast aluminum cylinder head. If you make any product that requires cool operation, the same factors can be put to work for you. The story appears on page 46.

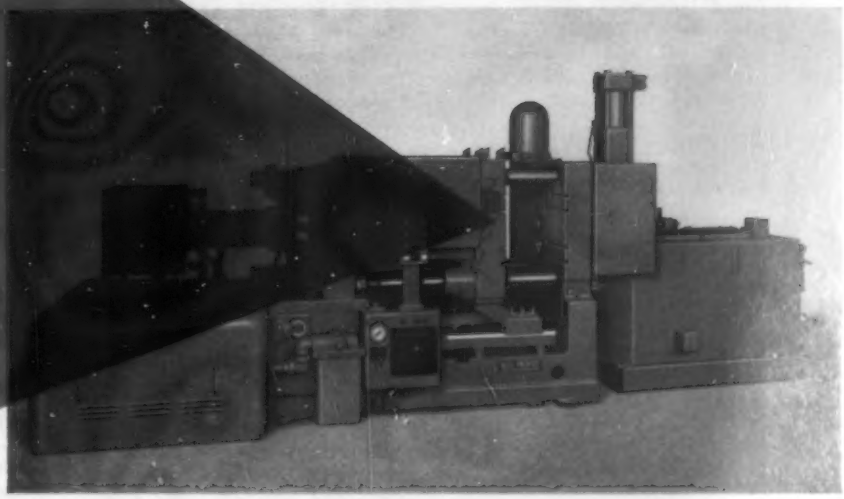
SHELF-APPEAL can be given to even the most prosaic item that ever graced a hardware dealer's counters by means of a recently perfected process known as vacuum metallizing. How one toy manufacturer used this type of finish to step up sale of his products is told beginning on page 51.

SUPERHIGHWAYS USE INVESTMENT CASTINGS? You bet! Next month we'll give you a report on some exceptional investment castings that are used in toll gate equipment for superhighways.

COMING UP are many informative articles, including; a detailed economic evaluation of the use of alloy metal powders; some specific suggestions on ways to save money with your paint spraying; an important article on the use of die castings in contemporary product design by one of the nation's leading industrial designers; and many others.

REED-PRENTICE
DIE CASTING MACHINES

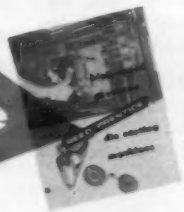
full locking tonnage --every shot



with REED-PRENTICE Positive Mechanical Locking Action

Exclusive REED-PRENTICE *positive*, mechanical die locking eliminates all "pressure back-off"... produces uniform, porosity-free, "Hardware Finish" zinc castings. Costly finishing operations are cut to a minimum, giving lower unit costs, higher production.

free



Complete specifications and information on REED-PRENTICE die casting machines. Write for your copy.

REED-PRENTICE CORP.

WORCESTER 4, MASSACHUSETTS
Affiliate of **PACKAGE MACHINERY COMPANY**

REPRESENTATIVES: Houston—Steel & Machine Tool Sales Co.; Seattle & Spokane—Star Machinery Co.; Minneapolis—Chas. W. Stone Co.; Los Angeles—Western Molders Supply Co.

BRANCH OFFICES: 75 West St., New York 6, N. Y.; 1213 West 3rd St., Cleveland 13, Ohio; 4001 N. Elston Ave., Chicago 18, Illinois; 2842 W. Grand Blvd., Detroit 2, Michigan.

For more information circle No. 55 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

3. DIE LUBRICANTS of the dry film type are fully described in reprint DC and bulletin No. 426-A. Both are available from Acheson Colloids Co.

6. ALUMINUM ALLOY for superior die castings is described and the chemical and mechanical properties listed in bulletin Z-39 published by Apex Smelting Co.

7. VACUUM DIE CASTINGS in aluminum bronze can be made for parts requiring the metallurgical and mechanical advantages of this alloy and casting method. A brochure from Aurora Metal Co. describes the product and gives much specific information.

9. AUTOMATIC CASTING of aluminum in die casting machines is now possible with the Ajaxomatic combined holding furnace and automatic pouring unit. The equipment is described and illustrated in folder G-3 from Ajax Engineering Corp.

12. POWDERED METAL presses of a new and advanced design are fully described and illustrated in bulletins available from Baldwin-Lima-Hamilton Corp.

13. INVESTMENT CASTING alloys, tailored to exact specifications are listed together with the chemistry and mechanical properties, as cast, in the MasterMet Alloy Bulletin from Cannon Muskegon Corp.

14. DIE CASTING MACHINES in eight new and improved models are described and full engineering specifications given in the catalog just published by Cast-Master, Inc.

19. DIE CASTING MACHINES said to incorporate some 35 points of design and construction superiority are fully illustrated and described in Bulletin 400 from Cleveland Automatic Machine Co.

26. ELECTROPLATE ALUMINUM with the Alumon process. How to do the job easily and economically is told in literature available from Enthone, Inc.

29. CONTROLLED FRICTION is the subject of an informative booklet that has been prepared for engineers by General Metals Powder Co.

31. THE HENNING MESSINGER, a monthly house organ of Henning Bros. & Smith, gives information on die casting applications and on die casting alloys.

33. SAVE MONEY by die casting. The Hoover Co. has issued a booklet "Die Castings" that tells how and lists many cases to illustrate the theme.

34. DIE CASTING MACHINES of a new and improved design are fully described in Bulletin 5400 from The Hydraulic Press Mfg. Co.

37. INVESTMENT CASTINGS to save production time and cut costs are the thesis of a 16 page booklet "Cast to Outlast" that has been published by The International Nickel Co., Inc.

39. DIE CASTING machines designed to produce castings to exact specifications are described in informative bulletins from the Kux Machine Co.

40. MELTING FURNACES for all metals in small batches are completely described in bulletins from Detroit Electric Furnace Div., Kuhlman Electric Co.

41. DIE CASTING applications, data and notes on die casting machines, plant tips and many other items of value to the die caster are in the Lester Press, house organ of Lester-Phoenix, Inc.

42. TWO-CHAMBER MELTING with Lindberg-Fisher induction melting furnaces is described and illustrated in bulletin 560 from Lindberg Engineering.

43. PLATABLE DIE CASTINGS in aluminum require superior casting ability. Case histories and informative details on aluminum die castings that can be easily and economically plated are available from Litemetal Dicast, Inc.

45. PREALLOYED POWDERS for high strength powdered metal parts are described, their chemistry and mechanical properties given in data sheets available from Metal Hydrides, Inc.

47. UNDIVIDED RESPONSIBILITY — for production of finished die and permanent mold castings is the special service described in Monarch Aluminum's Fact File on U.P.F. Unified Production Formula).

54. DIE CASTINGS to specification is the subject of a new booklet that has been issued by Racine Die Casting Co.

55. ENGINEERING SPECIFICATIONS on the latest designs in die casting machines are available from Reed-Prentice Corp.

59. MACHINING ALUMINUM is the subject of a new metallurgical report that has been issued by The George Sall Metals Co., Inc.

60. MELTING FURNACES and holding furnaces in all sizes for non-ferrous metals are described in the catalog of Stroman Furnace & Engineering Co.

62. CREATIVE CASTINGS is the title of a new booklet that has been prepared by the Light Metals Div. of Thompson Products, Inc.

64. IMPROVED BARREL finishing equipment is reported in detailed literature from Abbott Ball Co.

65. METAL FINISHING DATA for using the Iridite method and

Continued on page 19

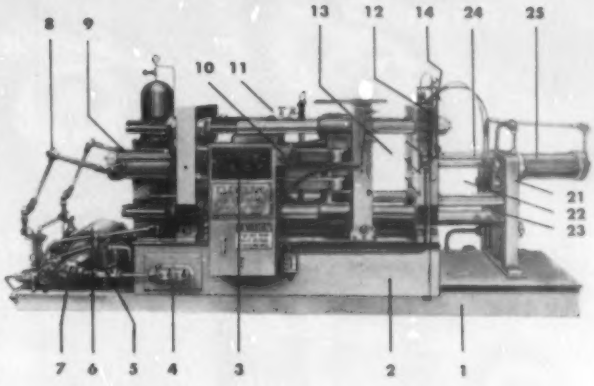
Why you can count on CLEVELANDS

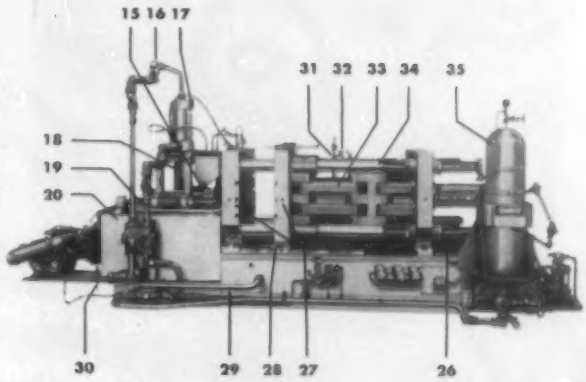
to give you precision quality die castings at a highly profitable rate of production

35 POINTS OF DESIGN AND CONSTRUCTION SUPERIORITY have made Cleveland Die Casting Machines the leader in this field. Many of these features are exclusive with Clevelands . . . others were pioneered by Cleveland and are now in general use throughout the industry. *All* add up to give Clevelands the qualities so essential for successful die casting:

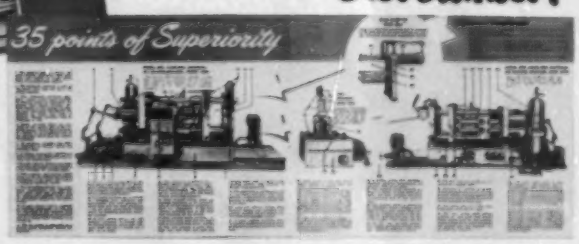
- Rugged, rigid construction throughout for dependable, economical performance
- Powerful die locking pressure
- Fast, shockless die closing and opening for high production operation
- High metal injection speed to produce sound, dense, "hardware finish" castings
- Safe and simple control—manual or automatic
- Ample elbow room for die mounting and machine maintenance
- Universal construction — easily convertible — for either hot or cold chamber operation

These are the reasons why Clevelands are selected by many of the nation's most experienced die casters . . . why *two* of the country's foremost die casting producers have installed 32 Clevelands each . . . and a *third* has installed 33! And why Clevelands can be found in 'round-the-clock production in 12 foreign nations as well. Let a Cleveland Engineer show you how Cleveland Machines can improve your production with money saved!





MAKE A POINT-BY-POINT COMPARISON OF CONSTRUCTION FEATURES . . . THEN YOU'LL CHOOSE *Clevelands!*



Bulletin 400 gives you complete details. Write for your free copy.

Photographs above, with 35 points of Cleveland superiority indicated, show front view of the widely-used Cleveland Model 400 with aluminum shot end, and rear view of the Model 400 with zinc shot end. Cleveland Model 400 has 36" x 38" die plates; 400 tons locking pressure. Other Cleveland machines include the Model 200, 30" x 31" die plates; Model 100, 22½" x 24½" die plates; Model 50, 18" x 22" die plates.

QUICK DELIVERIES NOW POSSIBLE ON MOST MODELS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
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SALES OFFICES: CHICAGO
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information circle No. 19 on the Reader Service Card

From: S. S. Wilson, V. P.
To: D.D.C. Sales Engineers
Subject: GOLD PLATED DIE CASTINGS
Advise your household appliance and automotive accounts of expanded facilities for precision zinc die casting and gold plating in all shades.
We will specialize in Sel-Rex precious metal plating to keep pace with the growing demand for highly styled products.
Recognized gold plating authorities staff our expanded department, to augment our experienced zinc die casting personnel.
Direct all inquiries here regarding our new service. They will be handled promptly.
Detroit Die Casting Corporation
597 BEAUFAIT STREET
DETROIT 7, MICHIGAN

REFERENCE DATA
continued from page 16

products is available from Allied Research Products.

66. BARREL FINISHING using Almco Supersheen methods and equipment is discussed in a new 52 page catalog from Almco Supersheen.

67. SELENIUM RECTIFIERS for all finishing operations requiring a D. C. source are described in a catalog from Bart-Messing Corp.

68. PAINT SPRAY MASKS. The uses, clamping and cleaning of paint spray masks are described in leaflets available from Conforming Matrix Corp.

69. PRODUCTION PLATING of zinc die castings is the subject of a new booklet that has been issued by The Four Plating Co., Inc.

70. BARREL FINISHING catalog from Grav-i-flo includes complete equipment, accessories and supplies for barrel tumbling of die castings and other metal parts.

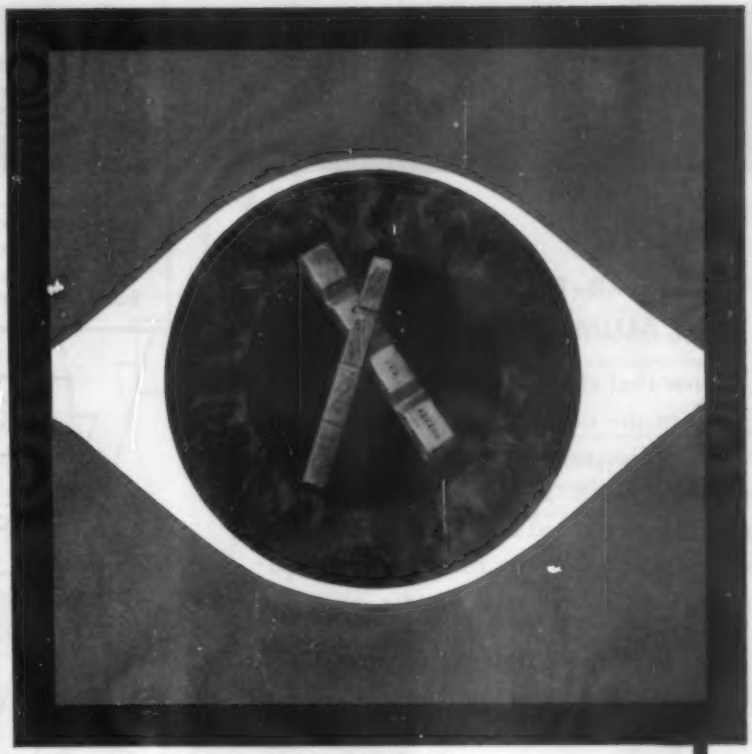
71. THREADED FASTENERS are gripped firmly with threaded inserts. How, where, when to use the inserts is told in descriptive literature from Groov-Pin Corp.

72. MANUAL ON BARREL FINISHING, covering all phases of this process, is available from Minnesota Mining & Mfg. Co.

74. FINISHING COMPOUNDS for use with barrel finishing machines are described and their properties given in detail in a booklet prepared by Oakite Products, Inc.

75. INCREASED DIE LIFE is made possible by Hydro Finishing. Bulletin 1400 A from Pangborn Corp. describes this method of finishing dies and other parts.

76. AUTOMATICALLY CONTROLLED chromium plating baths are possible with Unichrome SRHS baths. Bulletin SRHS-2 tells how. Available from United Chromium, Inc.



Let's look at the facts about die casting metals

Most people claim aluminum and zinc die cast alloys are pretty much the same wherever you buy them. Maybe. But that's not the point.

You want more than the *product* when you buy metal. You want *service* from your supplier.

Federated service gives you:

1. Research, constantly working to give you a new and better metal.
2. Practical Help, in your shop, by field experts whenever you have a metal problem.
3. Fast Deliveries; 14 plants across the country.
4. Metal Variety; any die casting alloy you need, aluminum, zinc or magnesium.

Try Federated metal-plus-service. It's the best metal plus the extra of competent technical help with your problems.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

Aluminum, Magnesium, Babbitts, Brass, Bronze, Anodes, Zinc Dust, Die Casting Metals, Lead and Lead Products, Solders, Type Metals

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Circle No. 23 on the Reader Service Card

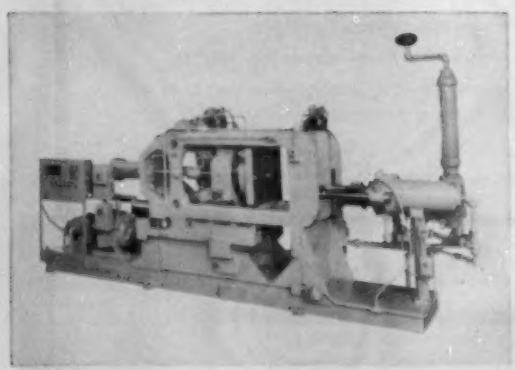
The most ever offered in a

The LESTER-PHOENIX HP-2½X-SF for ALUMINUM DIE CASTING

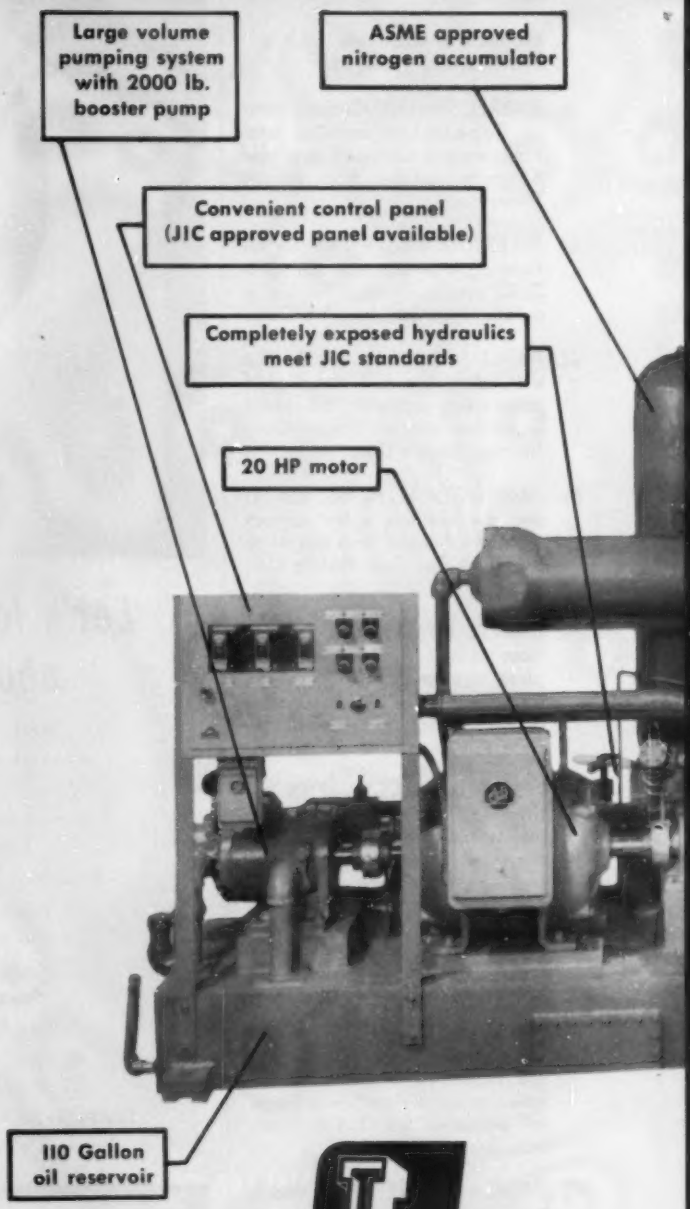
Now that this new Lester has taken its place in the industry, the conception of a 400 ton die casting machine will have to be revised upward. The HP-2½X-SF has size, shot capacity, speed and unusual ruggedness that makes it—on the basis of any comparison, including price—the leader in its class.

The backbone of this exceptional machine is the solid steel frame assembly which, combined with the massive toggle links, develops 400 tons of clamp—based not on designer's calculations, but on actual strain gauge tests! This basic structure, in turn, permits all of the outstanding features shown here.

And there are many more: ranging from automatic hydraulic ejection to convertibility to zinc die casting. For complete specifications write today to Lester-Phoenix, and also ask for regular copies of our house organ, "The Lester Press".

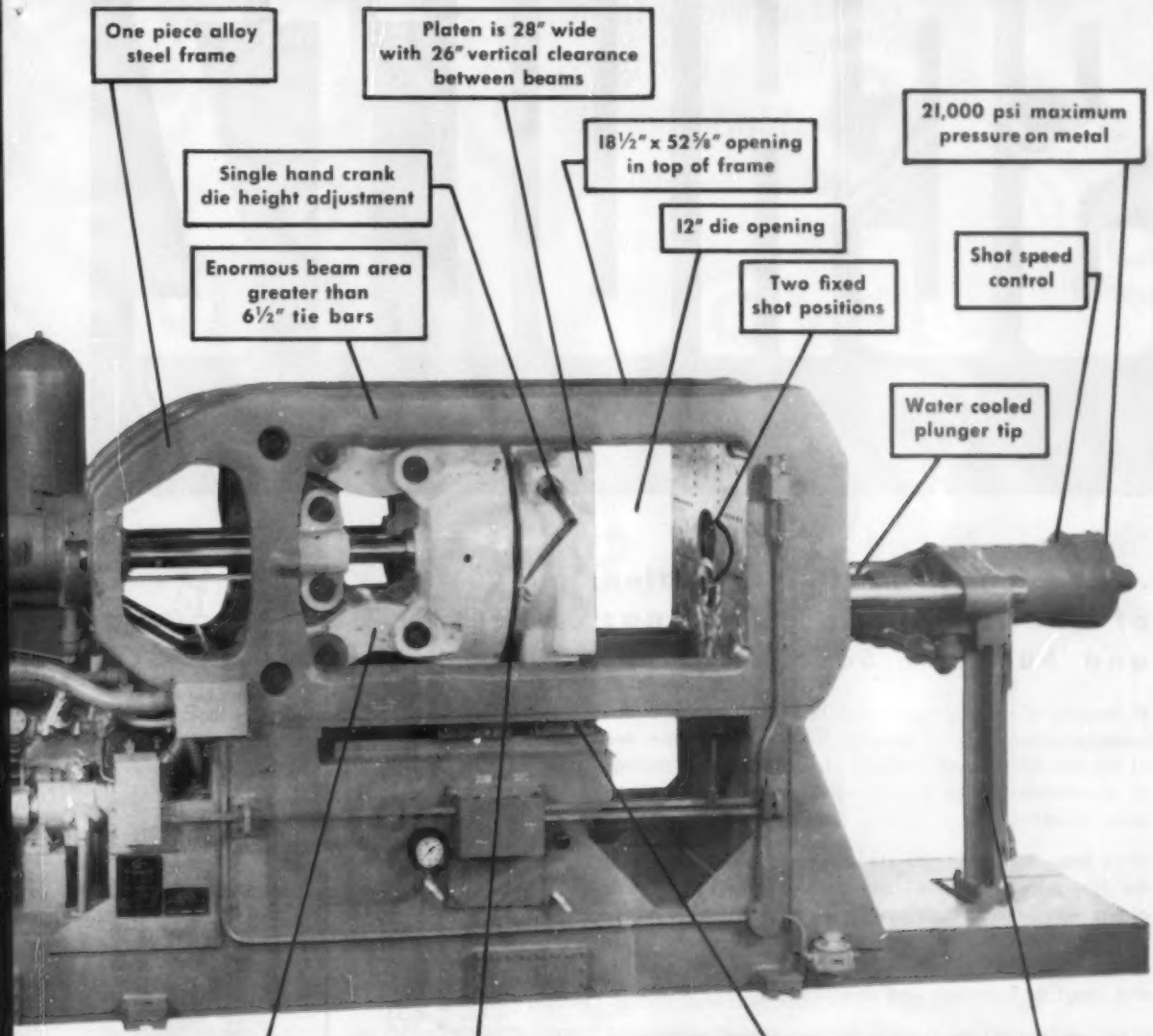


The HP-2½X-SF is also offered with the Pre-Fill injection system, increasing maximum shot pressure to 32,000 psi and also increasing shot speed.


Large volume pumping system with 2000 lb. booster pump
ASME approved nitrogen accumulator
Convenient control panel (JIC approved panel available)
Completely exposed hydraulics meet JIC standards
20 HP motor
110 Gallon oil reservoir

LESTER-

400 Ton die casting machine


One piece alloy steel frame
Platen is 28" wide with 26" vertical clearance between beams
18½" x 52⅝" opening in top of frame
21,000 psi maximum pressure on metal
Single hand crank die height adjustment
12" die opening
Shot speed control
Enormous beam area greater than 6½" tie bars
Two fixed shot positions
Water cooled plunger tip
High speed double toggle linkage with hardened steel bushing and pins throughout
Platen bolstered by large diameter adjusting screw
Platen supported on hardened steel gibs can't tip or sag
Rigidly supported shot assembly

PHOENIX DIE CASTING MACHINES

REPRESENTATIVES

New York	Steven F. Krould	Seattle	Perine Machinery & Supply Co., Inc.
Detroit	M. R. Tenenbaum	Cincinnati	Index Machinery Corp.
Chicago	J. J. Schmidt	Los Angeles	Seaboard Machinery Co.
Cleveland	Don Williams	San Francisco	J. Fraser Roe
Coral Gables	Morton Machinery Sales	St. Louis, Milwaukee	A. B. Geers

FOREIGN

Toronto, Canada	Modern Tool Works, Ltd.
Sydney, Australia	Scott & Holladay, Ltd.
Japan	Okura & Co., New York, Inc.
Stockholm, Sweden	Aktiebolaget Servus
Basle, Switzerland	Hermann Wolfi

distributed by LESTER-PHOENIX, INC., 2708-H CHURCH AVENUE • CLEVELAND 13, OHIO

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SCHULTZ

. . . is known for its production of quality Zinc Die Castings and Superior Service

■ Because of its long outstanding record for expert craftsmanship, reliability and integrity, Schultz has become one of the nation's foremost suppliers of quality zinc die castings to an ever-expanding list of manufacturers in more and more industries.

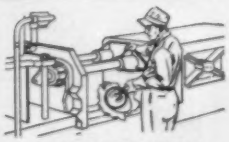
Users know that they will always get superior castings at the right price and on-time deliveries when they place their orders with Schultz. Each casting — be it simple or highly intricate, in large or small quantities — is produced under quality-controlled methods so that it is precise in analysis and exact in dimension and specifications.

If you need zinc die castings or design and engineering advice, call on Schultz — our specialized knowledge and service are at your call. We would welcome the opportunity to quote you on your needs. Send us your prints and we will furnish a prompt quotation.

DEPENDABLE ON-THE-SPOT SERVICE

DESIGN AND ENGINEERING SERVICE

DIE AND TOOL MAKING FACILITIES



MODERN PRODUCTION FACILITIES

QUALITY CONTROL FACILITIES

MACHINING FACILITIES

A COMPLETE AND DEPENDABLE DIE CASTING SERVICE

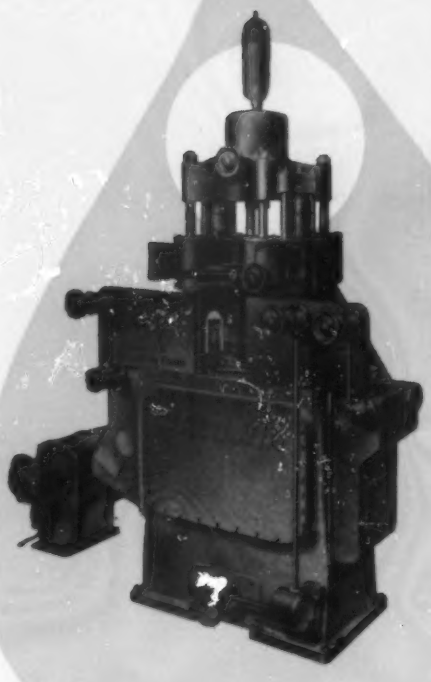
SCHULTZ DIE CASTING COMPANY

1810 CLINTON STREET • TOLEDO 7, OHIO

For more information circle No. 58 on the Reader Service Card

HYDRAULIC HEAD

avoids overloading, controls densities, in new Baldwin powdered metal presses . . .



YOU'LL GET a whale of a lot more by specifying a Baldwin Model "L" or Model "C" for your next powdered metal press. Why? Because these new Baldwin presses are the very first designed specifically for compacting powdered metals.

Here's just one of the reasons why it'll pay you to standardize on Baldwin to take care of your pressing needs . . .

Both the 50 ton ("L") and 100 ton ("C") presses feature a hydraulic head which supplies opposing pressure for the upper punch. It works like this: if the compressing pressure exceeds the setting of the hydraulic accumulator, the upper punch "gives" to the limit of the setting . . . that enables the hydraulic head to benefit you in three very vital ways:

1. It prevents overloading of the press, thus prolonging the life of both tools and press.
2. It makes it possible to compact powdered metal parts to more uniform densities.
3. It permits use of more delicate tools.

For copies of new bulletins with full technical information on Models "L" and "C" please write to our Department 4556, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pennsylvania.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

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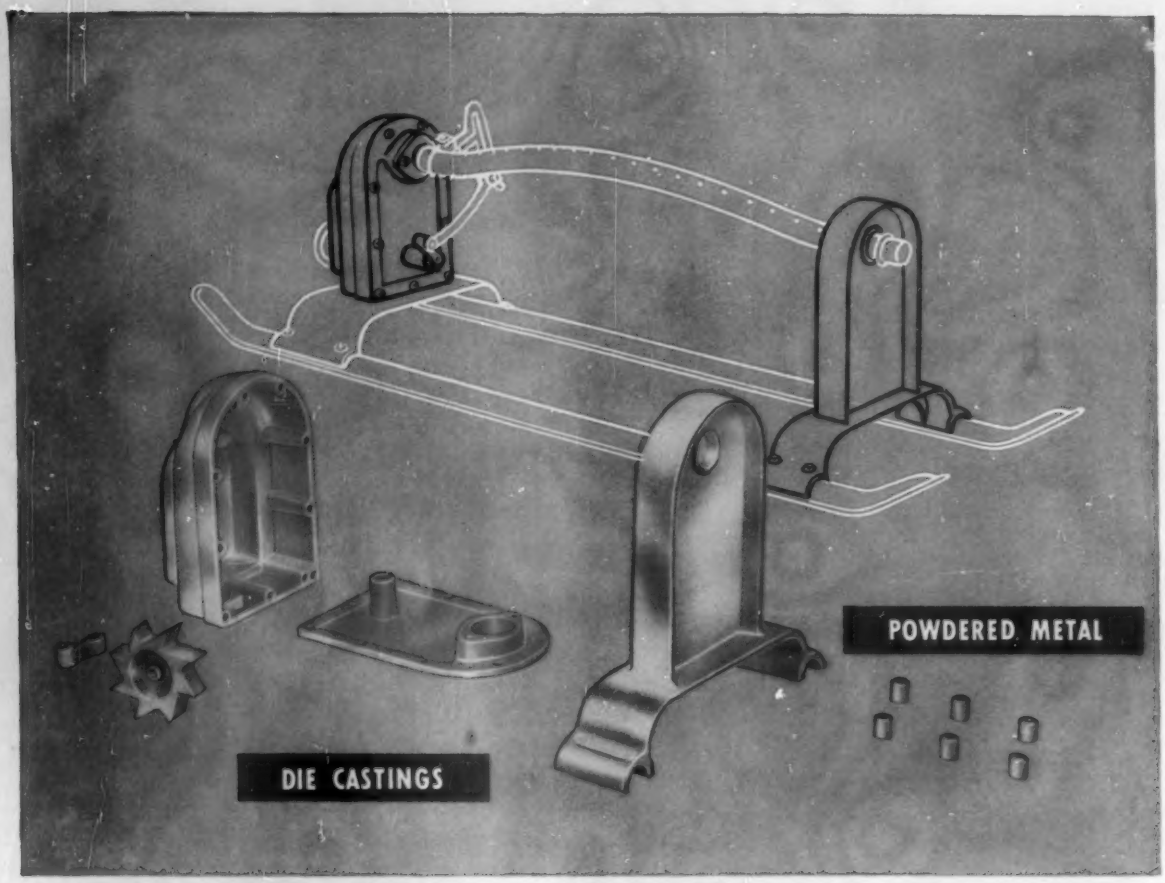

PARKER USES 2 MEANS TO Lower Cost END

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SALES ENGINEERS

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William H. Broxterman • 2174 Buck Street

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GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward P. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

Low cost—consistent with high quality—was the primary objective in producing important component parts for the popular lawn sprinkler made by Eastern Machine Products Inc. Parker gained this objective by making the end bracket, actuator housing, crank, and water wheel of aluminum die castings. The bushings inside the housing are bronze alloy sintered metal. The end result: component parts that meet every specification at lower cost.

This example emphasizes an important point about Parker service. No matter what your requirements in either die castings or powdered metal, Parker has the skill, experience and facilities to provide either or both. This undivided responsibility has saved money—and solved problems—for many users. Your problem may be one that Parker can solve in like manner. Just call the nearest Parker sales engineer listed at the left.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER **ALUMINUM and ZINC *die castings***

For more information circle No. 52 on the Reader Service Card

for Quality Production

AMERICAN ELECTROLYTIC

99.99+% SLAB ZINC

A reliable source for die casting requirements

AMERICAN ZINC SALES COMPANY

Distributors for

American Zinc, Lead & Smelting Company

Columbus, Ohio • Chicago • St. Louis • New York

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For more information circle No. 46 on the Reader Service Card

Die Castings by MILWAUKEE

...for Extra Values at No Extra Cost!

A pioneer in its field, Milwaukee offers you the experience and knowledge gained in helping others for more than 40 years, to realize the full benefits of the die casting process. In its modern plant, it offers you the most advanced facilities for the production of zinc and aluminum die castings. These extra values which cost you no more, can help you build extra values into your product, too.

We operate under the Certified Zinc Plan of the American Die Casting Institute, Inc.

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

For more information circle No. 29 on the Reader Service Card

NAMES IN THE NEWS

Two new distributors have been appointed by the *Reynolds Metals Co.* **Aaron Ferer & Sons, Inc.** will distribute aluminum pig and ingot out of Los Angeles, Calif. and **Globe Metals Co.** will handle the same product out of Oakland, Calif.

Six new technical employees have recently joned *Hooker Electrochemical Co.* **Ralph Resnick, Roger N. Pauls, Joseph A. Gilles, John D. Parkes, Donald W. Brown** and **Richard F. Zimmermann.** All six men have been assigned to the process study group.

H. D. Emmert has been named as chief engineer of *Allis-Chalmers Mfg. Co.*, steam turbine section, powder dept.

Donald B. Scott has been appointed as engineer-in-charge of sales for the induction heating group of *Allis-Chalmers Mfg. Co.*

The *Detrex Corp.* has announced the appointment of **Platt K. Wiggins** as sales representative covering western New York State.

The *Aluminum Company of America* has made three new appointments in its metallurgical departments. **C. L. Kessler** is the new chief metallurgist at the Massena, N.Y. works; **A. M. Miller** becomes assistant chief metallurgist of the Edgewater, N. J. works; and **F. O. Traenknar** is the new assistant chief metallurgist of the Massena, N.Y. works.

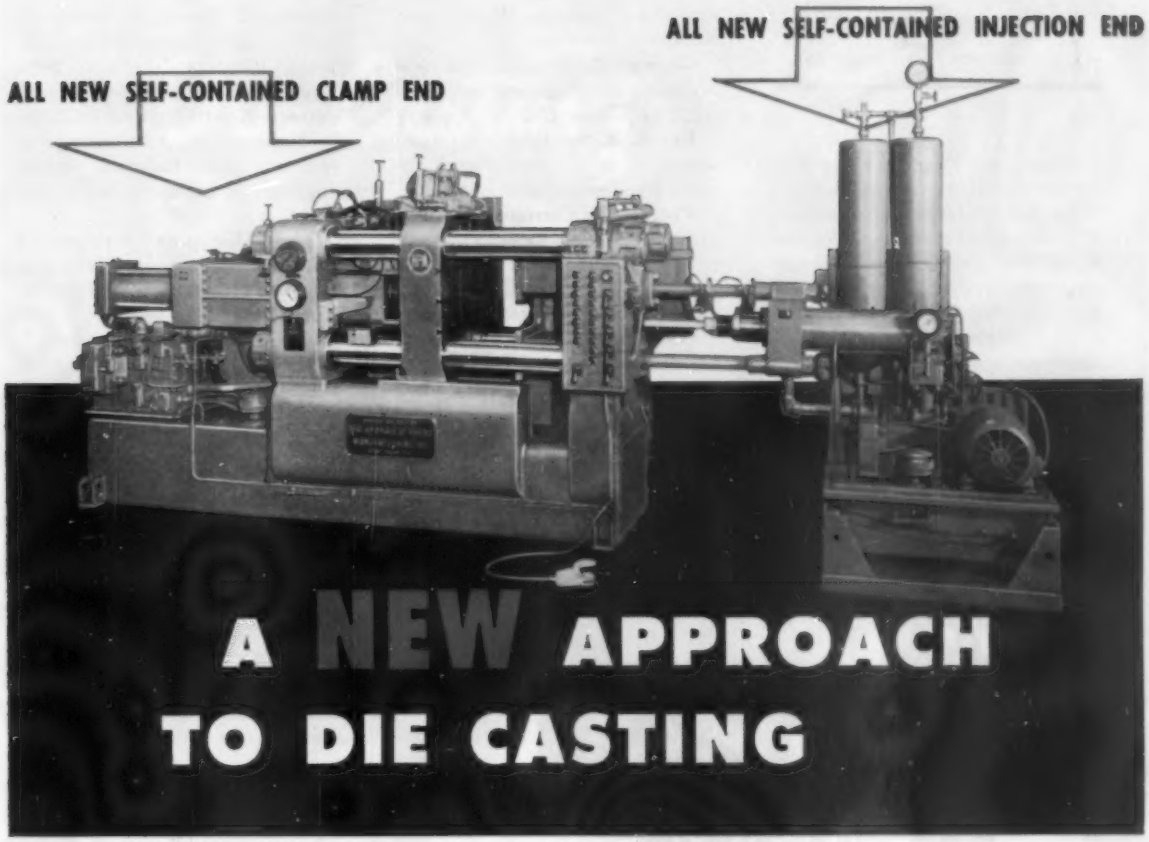
Dr. Bennett S. Ellefson has been appointed technical director of *Sylvania Electric Products, Inc.*

A. T. Olsson has been named as assistant sales manager of *Acheson Colloids Co.* and **Norman T. Bauer** service engineer for Chicago.

Amco Furnace Contractors, Ltd. has been appointed as Canadian representative of the *Harper Electric Furnace Corp.*

Henry Voelker has been named sales representative in

Continued on page 28



New H-P-M Die Casting Machine offers more than just New Machine Design

The new H-P-M die casting machines are being hailed as the most important advancement in die casting in fifteen years, and rightly so . . . more than forty new and improved features! These features result in minimum mold flash . . . faster die set-up . . . greater versatility in die usage and casting design... reduced maintenance . . . maximum safety and performance. The new self-contained Link-Wedge mold clamp is the best. There's plenty of "beef" in these new models. They are available in a complete range of sizes...cold chamber or gooseneck types.

Write for Bulletin 5400 which describes these new units in detail.

HPM

THE HYDRAULIC PRESS MFG. COMPANY
1094 Marion Rd. Mount Gilead, Ohio, U. S. A.

For more information circle No. 34 on the Reader Service Card

NAMES IN THE NEWS
continued from page 26

Indiana and Kentucky for *National Precision Casting Corp.*

Carboloy Dept. of *General Electric Co.* has added **Donald K. Miner** and **J. David Benedict** to the newly formed vacuum melted alloys section.

Dr. Nevin K. Hiester has been appointed manager of the chemical and metallurgical engineering section of *Stanford Research Institute.*

George P. Staats is the new assistant development engineer for *The Trane Co.*

Frank Y. Speight has joined the staff of the *American Society for Testing Materials.*

Patrick E. Lannan has been appointed vice president and project manager of electronic research and development by *Designers for Industry, Inc.*

Naresco Equipment Corp. equipment sales subsidiary of *National Research Corp.* has appointed **Harry D. Stone** as district sales engineer for Ohio, West Virginia, western New York and Pennsylvania, and eastern Kentucky and Indiana.

Hjalmar A. Anderson was recently appointed chief project engineer of *Lindberg Industrial Corp.*

The Matthews Equipment Co. will represent *Wakefield Bearing Corp.* in Virginia, North Carolina, South Carolina, Georgia and Tennessee.

Maxwell Steel Co., Inc. has been appointed as exclusive sales representatives for Texas for *A. Milne & Co.*

G. Ray Friedrich has been appointed sales representative in southern Illinois, western Indiana, western Tennessee, Arkansas, Colorado, Kansas, Louisiana, Missouri, Oklahoma and Texas for *Beardsley & Piper.*

George W. Kessler has been appointed chief engineer of *The Babcock & Wilcox Co.,* boiler division.

BOOK REVIEWS
continued from page 10

and accessories that make up actuating and control circuits for industrial machines and mobile equipment.

The three sections of the volume — Air Properties and Characteristics, The Distribution System and Power and Working Elements—have been arranged not only for the beginner in pneumatics, but also as a convenient orientation in fundamentals for men skilled in other specialties.

"A Beginner's Course in Basic Pneumatics" is an enlargement and rearrangement of material first published serially in APPLIED HYDRAULICS Magazine (1952-1954). The requirements of company training programs as well as individual reference use has been kept in mind. It is the first volume to give systematic attention to the principles and basic equipment of industrial pneumatics.

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Die Casting

enables 1 maker to use the same 2 parts for 3 different tools

CASE HISTORIES FROM MT. VERNON FILES

While we have introduced the economies of die casting to manufacturers in many fields, it strikes us that Millers Falls Co., Greenfield, Mass., comes closer than most to gaining the *maximum* benefits from making die cast parts interchangeable.

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Other advantages inherent in these die-cast parts are light weight combined with strength to withstand the vibration and pounding these tools receive—also, even with intricate designs such as these, die casting is done to such close tolerances that machining is minimized.

Whatever *your* product, you can almost certainly profit by considering the advantages of die casting: light weight, simplicity, lower costs. Our varied experience of many years is wholly at your service. Let us know your needs today.

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City Buses Gave Them Their First Trial . . . Now →

1. FREQUENT STARTS and stops under heavy loads wore-out fabric clutch facings and brought in the era of metallic friction materials. (All illustrations, courtesy General Metals Powder Co.)

Metallic Friction Materials— Their Durability and Performance At High Temperatures Bring Them Many Jobs

FRICTION surfaces made from metal powders can no longer be classified as something new. First introduced in 1931, today the "metallics" are pretty well recognized throughout industry as the natural selection for many uses and one of several possibilties for other applications.

In order to be of any use, friction materials must necessarily be planned as an integral part of engineering designs. It is usually the design engineer who is responsible for the selection of the type of friction material to be used as well as for design of the unit utilizing the product. It seems reasonable to assume that he will be quite familiar with the types of friction surfaces available to him and knows that "metallics" are one of these. His problem is simply to select the product which will permit him to do the job satisfactorily at the lowest overall cost.

This is not necessarily as simple, however, as it may appear. A theoretically perfect choice would have to assume that all materials considered were worked to their capacity in order to design for best economy from a space and weight standpoint and, of course, would have to take account of the obvious factors such as wear-life and maintenance costs.

The ever-present companion of friction is heat. The ability of the friction surfaces to conduct this heat away and to withstand the residual temperature will be an important consideration in determining these space and weight requirements.

The "metallics" differ from other types of friction products in several ways which will affect their work capacity on any particular job. A great deal of research has been done and is continuing at present to find the correct engineering answers to this problem of choosing friction materials in specific applications and, as may well be suspected, complications frequently arise which make honest differences of opinion entirely possible.

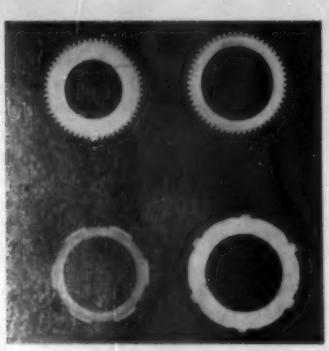
One thing does appear certain: the friction material must, in most cases, be engineered for the particular job, taking into account all the factors surrounding the application. Specific answers can only be given where all pertinent considera-

Continued on next page

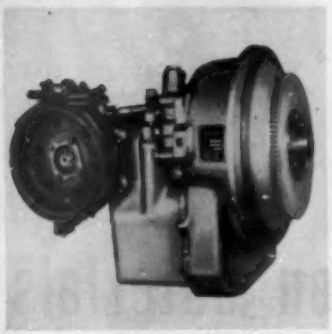
2. Buses

3. Earth Handling Equipment

4. Miscellaneous Industrial



5. Miscellaneous Industrial



6. Automatic Transmission

7. Aircraft

Friction Materials—Cont.

tions are known and taken into scription of the process used in account. However, a brief description of the process used in manufacture of the "metallics" and a few representative applications of jobs where the "metallics" have been properly selected, with basic reasons for this choice, may be helpful in a general way.

How They Are Made

Basically, the metallic friction materials are products of the powder metallurgical process. To incorporate into a single mixture, metals, lubricants and non-metallics is an impossible task for other metallurgical processes, particularly when micro-homogeneity is a basic requirement.

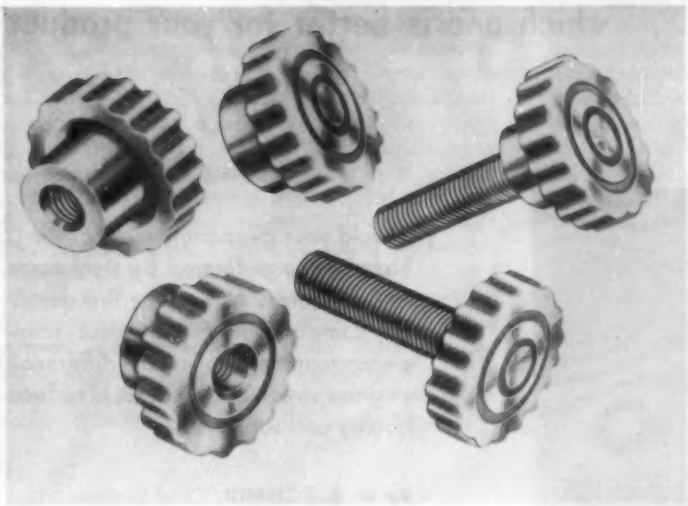
There is, of course, some variation among the different manufacturers both as to composition for any given application and the method of manufacture, but there are a few general principles that are common throughout the industry.

In practically every case, these materials are copper base. Tin, zinc, iron or other minor alloying elements are added as hardeners. Lead, graphite, molybdenum disulfide or similar materials are usually incorporated as lubricants and

Continued on page 53

These Are Reasons For Using Metallic Friction Materials

1. They can operate over a temperature range that is far wider than for other types: 65F to above 200F and momentary temperatures considerably higher can be tolerated.
2. The rate of heat transfer away from friction surfaces is higher than for non-metallic materials. This, together with their ability to operate at higher residual temperatures than other materials, allows design of smaller units than would otherwise be possible.
3. Because of their almost micro-homogeniety, the frictional characteristics are constant over the entire life of the unit.
4. Their wear rate is extremely low.
5. They give smooth and extremely close torque control under all operating conditions specified above.



THE DIFFERENCE between largest and smallest OD represents the waste of metal and machine time required to turn these thumb nuts and screws, left, on a screw machine. By die casting them, there is virtually no waste of metal or labor. The die cast zinc wing nuts, above, have been standard items for years.

Low-Cost Fasteners By Die Casting

DURING the war, the Germans were reported to have turned to die cast aluminum nails to solve one of their materials shortage problems, but during recent years, American industry has found that die cast fasteners have many advantages in normal competition with other types of fasteners.

Wing nuts, rivets and specialized fasteners for the textile and jewelry fields, for example, have been in standard production and are widely used. Now Gries Reproducer Corp., who manufactures a complete line of these standard die cast items, has introduced another type of standard die cast fastener in the form of round head thumb nuts and screws for replacement or adjustment applications.

Types of use expected to be made of these zinc die cast fastening devices are baby carriages and furniture, outdoor furniture, knocked-down furniture, storm windows and screens, electric fans, mops, wax applicators and display fixtures.

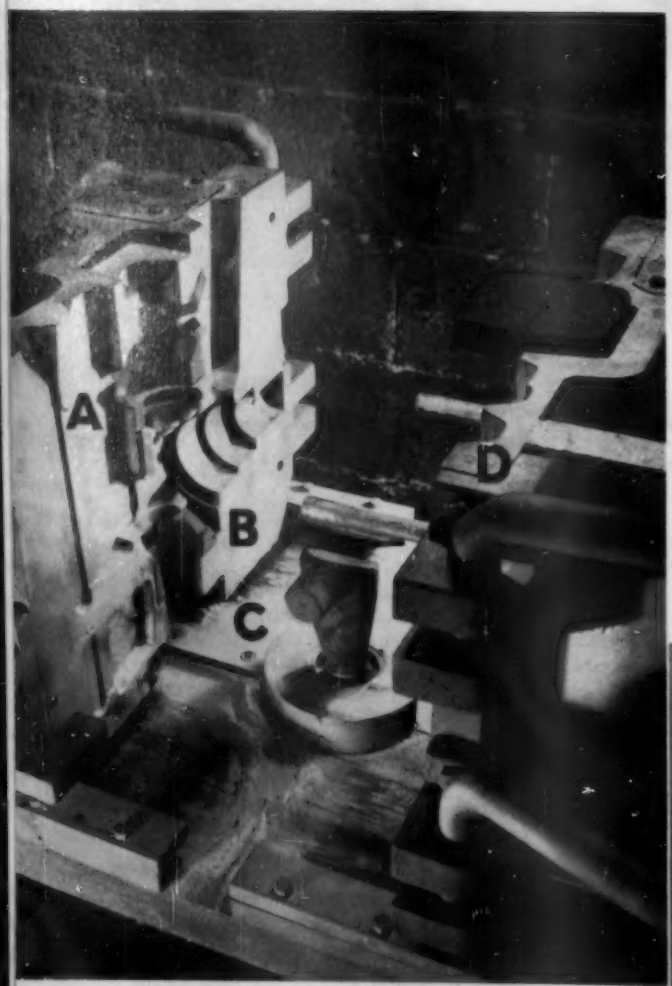
Die casting permits the use of an extra-wide head to make it easy for assemblers to get a quick, sure grip. Turned nuts would yield a tremendous scrap loss if such a large head were to be used, making it uneconomical. By die casting, there is no scrap loss of this type.

Several other advantages stem from the idea of producing these fasteners as zinc alloy die castings: 1) the sharp, unpleasant edges of machine knurling are replaced by easy-to-grip scallops; 2) the non-ferrous alloy is non-rusting and corrosion-resistant; 3) for many uses, these die cast fasteners need no surface coating, but they are available in all commercial finishes; 4) die cast threads are clean, accurate and uniform.

These thumb nuts and screws are now being produced in three standard head diameters, with all standard thread sizes, and in four basic variations: open and closed end thumb nuts, or thumb screws with or without shoulders.

FULL PERMANENT MOLD OR

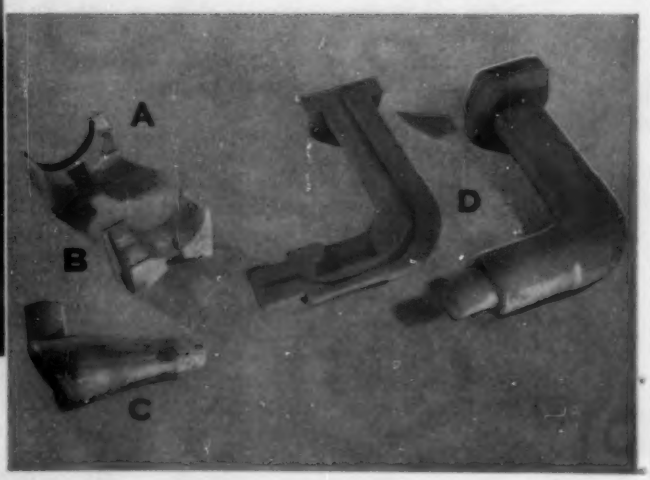
. . . which one is better for your product?



THE SAND CORES, right, go into the steel mold as indicated, to produce complex openings and undercuts in this semi-permanent mold.

Should your permanent mold castings have openings formed by steel cores or sand cores? Here is the first detailed comparison of full versus semi-permanent mold, telling the difference in grain structure, tolerances, surface quality and tool cost.

By G. E. SCHMID, Chief Engineer
Commercial Casting Div.,
Monarch Aluminum Mfg. Co.



SEMI-PERMANENT MOLD CASTINGS

THE permanent mold process for the fabrication of high strength castings has been developed during the last 40 years to produce almost any type of casting desired. Its versatility, offering high physical strength and soundness in simple or complex designs, makes it a process that should be thoroughly investigated and considered by every design engineer. The permanent mold process offers limited or mass production under optimum conditions at reasonable tool costs.

While the process was originally developed as an improvement over aluminum sand casting methods, it has been widely used in the production of magnesium permanent mold castings, and lately has been successfully used in the casting of bronze. The principles of the permanent mold method have even been successfully employed in mass production of gray iron castings. This article, as a basis of comparison, will be limited to the conditions applying in the casting of aluminum alloys. The permanent mold process is divided into two distinct categories which are referred to as *full permanent mold* and *semi permanent mold.*

A full permanent mold, as the name implies, is completely constructed of Meehanite or equivalent cast iron or steel. All component parts of the mold are permanent and operate continuously to produce thousands of identical castings before the mold materials need replacement because of wear. Cores can be pulled at various angles, depending on design, and many undercuts can be cored with loose metal pieces or collapsible metal cores.

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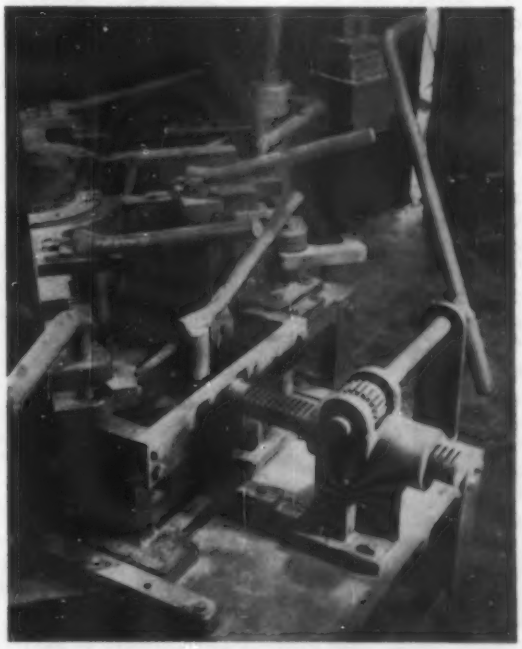
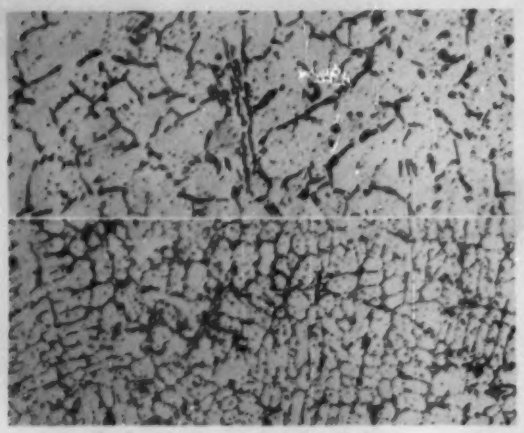
SIDE HOLES formed at various angles around the circumference of this full permanent mold casting (shown on top of the mold) . . .



ARE FORMED by a large number of steel cores pulled manually by means of rack and pinion arrangements shown above.



MICRO-STRUCTURE of semi (top) and full (bottom) permanent mold castings. The difference in structure due to the different rates of cooling is clearly evident. Both micro-samples from the same casting. (100X, HF etchant, reproduced full size).

Whenever a casting design allows the use of a full permanent mold, this method should be specified for optimum cost, production output and uniformity.

A semi permanent mold, also as the name implies, uses parts of the mold made of disposable material, namely sand, that can be used only once for each casting produced. This type of mold is used when the casting design includes undercuts of a nature that make loose pieces or collapsible metal cores impractical to withdraw from the casting. This process is also practical for low production requirements where the intricacies of a full permanent mold would result in an exorbitant equipment and casting cost and restricted production performance.

Dry sand cores are normally used in semi permanent molds. Recent articles have covered developments in the use of plaster or shell molded cores to replace the use of conventional dry sand. These new methods, which are still primarily in the development stage, are designed to offer smoother cored surfaces and closer tolerances in the cored areas. Comparative cost factors of these new coring methods to conventional sand cores are not generally established yet.

In typical semi permanent mold castings, one or more sand cores can be used to form the inside area of the casting and additional sand cores can be used to form undercut areas on the outside of the castings. These cores are located in the main permanent mold replacing sections that would be constructed of metal in a full permanent mold.

The prime problem in the design and operation of a semi permanent mold is the location of the core or cores, since the core must always be properly supported to maintain its location in the metal portions of the mold. These supports are known as core prints, extending beyond the body of the sand core at the points where the core forms the internal opening in the casting.

In addition to supporting the core, the prints serve as vents to allow the core gases to be dissipated freely to avoid trapping this gas in the metal — in pockets which are usually referred to as gas blows.

Tolerance Problem Due To Sand Core

One of the major problems in the use of sand cores in semi permanent molds is the placing of the core in an accurate position in the mold. The sand core, properly produced, is softer than the cast iron in the mold itself. If the core rubs against the mold when it is placed in position, it will loosen some of the surface sand from the core. This will not only alter the size of the core in respect to the dimensions of the cored area but will also affect the size of the core print area and make a loose fit when the core is placed in location in the mold. A loose fit will cause mislocations of the cavity sections formed by the sand core.

As a result, semi permanent mold castings require greater tolerances than castings made from a full permanent mold. The heat from the metal sections of the mold contributes to the problem of placing the core in the mold. The mold operator must be able to insert the core in its proper location quickly and accurately and the dimensions of the core prints must be carefully established and accurately held in the core making operations to accomplish this operation successfully.

If these two essentials are not maintained and too much time is lost in trying to fit the sand cores, the metal portions of the mold are very likely to cool below the established temperature and a bad casting will result. Any loose sand particles will usually wash into the molten metal as it is poured, thus contaminating the alloy.

Do not underestimate the importance of the operations outlined in the preceding paragraph. They are more important in semi permanent mold castings as opposed to normal sand castings since the placing of sand cores in a complete sand mold does not present these problems. In sand casting, the sand core is placed in a cold sand mold and is usually imbedded in a manner which reduces crushing and gives a more secure location. The tolerances maintained in a sand casting are usually liberal enough to offset the difficulties that can be experienced in semi permanent mold operations.

The withdrawal of core gases from a semi permanent mold is usually accomplished by placing the sand core in the mold in a position that will allow the gases to seep through the core prints. Since these gases normally rise, the core is usually suspended from the top of the mold. There are always cases where this is impractical because of the design of the casting and these castings will show the results of gas blows from the core in the

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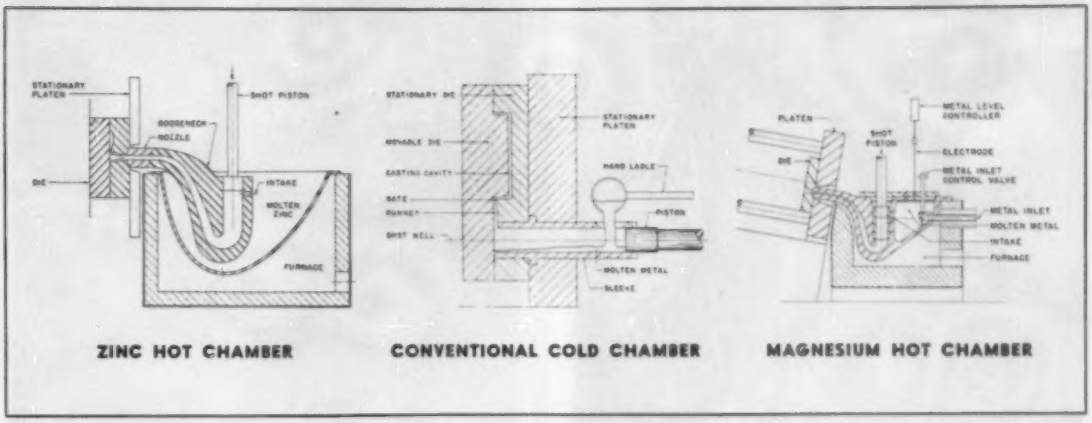


ZINC HOT CHAMBER | CONVENTIONAL COLD CHAMBER | MAGNESIUM HOT CHAMBER

1. COMPARE THESE DRAWINGS which illustrate the three basic types of injection systems used for die casting zinc, aluminum and magnesium.

Magnesium Die Castings Get A Boost

As New Machine Steps Up Rate of Production

CAN YOU USE magnesium die castings in your product? The introduction of this new method of casting magnesium in a hot chamber machine may make it economical for you to take advantage of the lightweight metal. Here's a report on this casting technique, what it is, what it can mean to buyers and producers of die cast components.

WILL magnesium join zinc and aluminum as a large-volume die casting alloy? The key to this question may lie in a new "hot chamber" die casting machine recently introduced by Dow Chemical Co.

Magnesium, like aluminum, is conventionally cast in a "cold chamber" machine in which the molten charge is hand ladled into the relatively cold shot chamber before each casting cycle. In zinc die casting, on the other hand, the shot plunger is submerged in a holding pot of molten alloy, eliminating the need for hand ladling and thereby, speeding the casting cycle. This type of machine is identified as a "hot chamber" machine.

The new machine described by Foster C. Bennett of Dow's Magnesium Department before the annual meeting of the Magnesium Association is an adaptation of the hot chamber principle for casting magnesium, and has been in development for ten years, producing for four.

Diagrams of the three types of die casting machines, Figure 1, reveal the basic differences.

How the Machine Operates

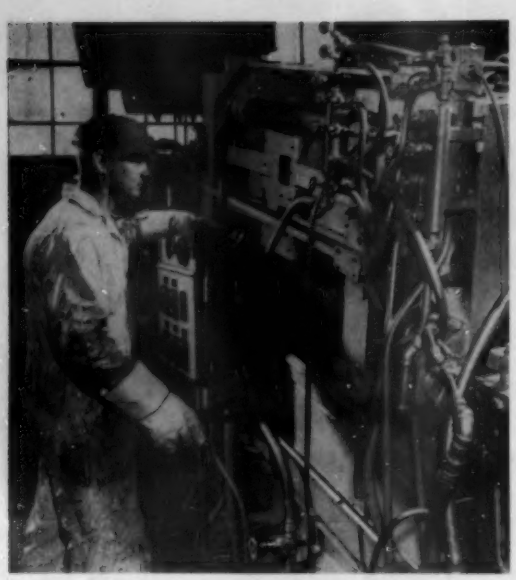
The manner in which the hot chamber magnesium machine operates is as follows[1]:

1. A supply pot or furnace is used to hold an inventory of refined metal and absorb the fluctuations between demand and supply as the melting and casting operations proceed.

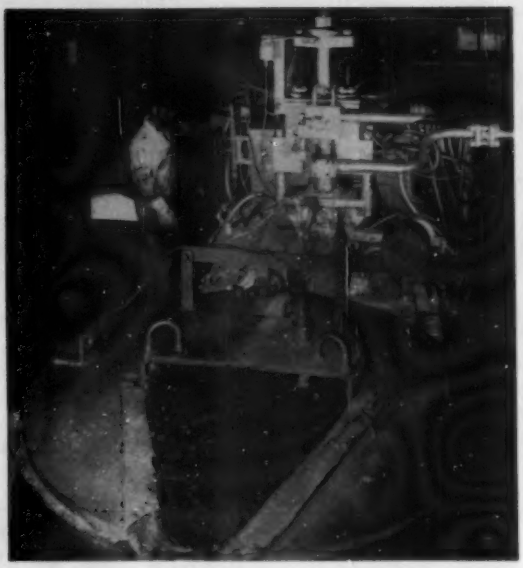
2. A gravity flow or siphon pipe carries the molten metal from the supply pot through a control valve to the injection gooseneck.

3. An electrical float indicates the level of the molten metal in the injection gooseneck and controls it within close limits by automatically opening and closing the supply line valve.

4. An hydraulically operated piston forces metal through a closed injection gooseneck into the die as in the standard zinc hot chamber machine.



2. CASTING CYCLE starts when the operator presses a control button. Opening and closing the die and injection of metal are automatic. In the case of small, symmetrical castings, the entire process can be set to operate automatically.



3. HOLDING POT (foreground) is kept supplied by the melter. The molten magnesium is transferred automatically on demand to the reservoir of the machine. On top of the machine is the injection piston, the plunger end of which operates in the molten metal.

Magnesium Die Castings—Cont.

The volume and surface area of the molten metal are minimized in the plunger unit which is designated a "continuously supplied gooseneck". The horizontal die clamping mechanism is substantially a conventional toggle-type device supplied by a commercial machine source. A vertical parting plane was chosen to simplify die setting and cleaning, increase safety and minimize heat transmission to the stationary platen.

This new machine can be set to run automatically so that ingot charged at one end can be taken away as die castings at the other. Usually, however, the complexity of the part being produced is such that the operator must give the die close attention. Therefore he carries out any required lubrication of the die, starts the casting cycle and removes the finished cast.

Development work at Dow started in 1944 with the purchase of a conventional 70-ton zinc hot chamber machine, adapted for magnesium by means of a flux cover over the melt to prevent formation of harmful oxides and nitrides. This was followed with construction and operation of a 400-ton unit along similar lines. In 1949, the flux-covered pot design was discarded in favor of a closed unit, in which the injection gooseneck was taken out of the pot of molten metal, and an electric resistance furnace designed to keep the gooseneck up to temperature.

Operating Advantages Claimed

Among the basic factors listed by Mr. Bennett as being responsible for the advantages of the hot chamber magnesium process, are virtually complete metal protection, low injection pressures and automatically controlled metal supply.

Operating advantages claimed by Mr. Bennett include:

1. The holding pot does not need to be located near the charging end of the die casting machine, but can be separated from it by a wall. Thus, the melter services the pot without interrupting casting operation, choice of melting furnace systems is permitted, temperature variations are smoothed out, less labor is required to transfer metal to the machine, there is no movement of open metal-carrying containers.

2. Less oxide is formed, less flux is required for refining, and less sludge is removed on completion of refining.

3. Uniform metal injection temperature eliminates problem of chilling, sometimes encountered in hand ladling of metal into a cold chamber. The latter may result in introduction of metal as a heterogeneous mass, requiring increased injection pressure.

4. Wide range of castings can be made with one size piston because injection automatically ceases when the mold is filled.

5. Piston is automatically lubricated by molten metal.

6. Die fills rapidly without excessive transient pressures.

7. Drippage in the sprue area has been eliminated and the nozzle is firmly affixed to the die.

8. Completely automatic production is possible where job volume warrants extra set-up effort.

9. Low injection pressure permits use of smaller die blocks, core locks, core cylinders, etc.

10. Lower pressure results in lower die maintenance costs,

Continued on page 48

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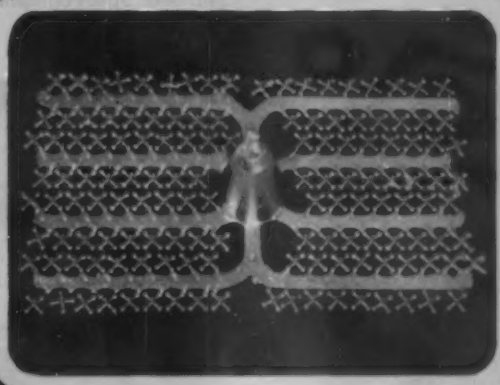
telling the story of 'dag' dispersions

Die Sticking Prevented by Dry-Film Lubricants



Try 'dag' Colloidal Graphite as a die lubricant. Here's why it's so good:

It's slick as a whistle, wholly unaffected by heat up to 750°F., and is easy to apply. 'dag' dispersions can be sprayed or painted on your dies, or put on by dipping.

Dies treated this way with 'dag' Colloidal Graphite take on a *dry lubricating film* that eliminates sticking, improves finish, and reduces carbon build-up in die impressions.

It lubricates ejector pins and plungers, too, so they won't stick or jam. Try a 'dag' dispersion and see! More details are yours by asking for Reprint DC and Bulletin No. 426-A.

Dispersions of molybdenum disulfide are available in various carriers.

We are also equipped to do custom dispersing of solids in a wide variety of vehicles.

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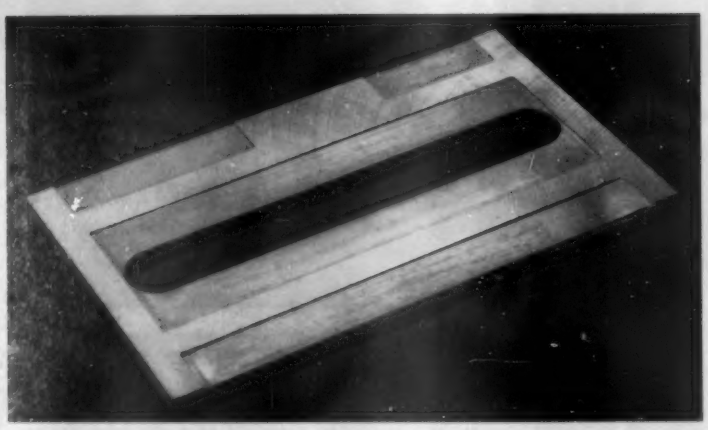
try resin-bonded dry graphite films for permanent lubrication

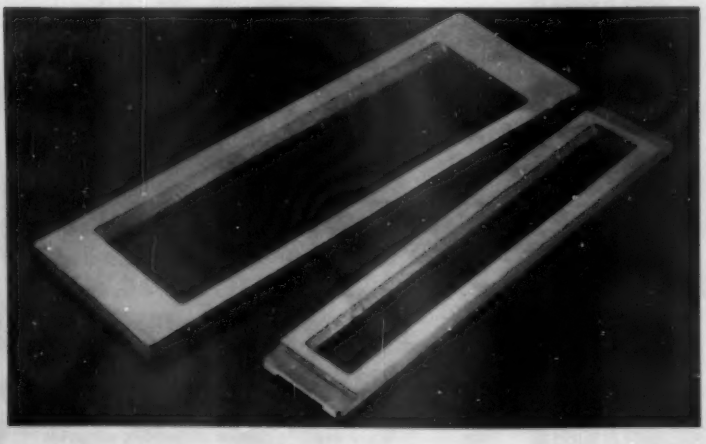
PRECISION means more than dimensional accuracy . . . it can also apply to surface quality, flatness and parallelism. Here is an example of close requirements on flatness over a large area, and the way plaster mold castings have met the specifications.

FLATNESS

BY WALTER UGICCINI, Chief Engineer
National Spectrographic Laboratories, Inc.



1. Almost optical flatness is required in this carriage plate. Surface grinding is required but the casting itself must be sufficiently flat, before grinding, so that the bearing pads will not be destroyed in the machining operation.



2. Flatness, depth and width of the cast recesses are closely held on this film and plate holder. Because of the accuracy of the plaster mold casting process it has been possible to design a two piece unit instead of the two complete holder units formerly required.

WHILE sand castings are still used to a great extent in the manufacture of optical goods, the inability to secure acceptable surfaces, to hold adequate dimensional tolerances and to deliver parts that consistently meet the flatness requirements are problems of concern to every designer of optical equipment. For many of the aluminum castings used by National Spectrographic Laboratories, Inc., a solution to this problem has been found by using plaster mold castings.

Sand castings, used originally, showed such a high rate of rejects due to lack of flatness that the per-piece costs were excessive. A further disadvantage of sand castings that dictated a change in manufacturing method was the great amount of expensive machining required to ready the castings for use. Some typical examples will make these objections, and their cure, clearer.

Evolution of a Flat Casting

The carriage plate for a densitometer, a device used to measure the "blackness" of a line on a spectrogram, is shown in Figure 1. The carriage plate moves across the densitometer so that the spectrograms can be scanned and the particular line to be measured properly located. The plate or film holder is mounted on this plate and it, in turn, moves so that the proper spectrogram can be selected. Since a densitometer uses an optical magnifying system, this carriage plate must be

Can Be The Toughest Problem...

as close to optically flat as possible.

Original design: The plate has pads on which various parts ride. Any deviation from flatness or parallelism would throw the plate out of focus. As originally made, the carriage plate was cut from a cast tool and jig plate and fully machined. To save material the bearing pads were made as separate pieces and fastened to the cast plate. This method of construction was expensive and did not give as freely operating a part as could be desired. A change was made, therefore, to a sand cast part.

Change No. 1: As a sand casting, machining to secure the proper size and shape of hole in the plate was still essential and, in addition, surface grinding was needed to bring the pads into correct flatness and parallelism. This latter operation gave the most trouble since warpage of the casting would often result in a pad being ground completely off to secure the desired surface. This, of course, would result in a scrapped plate.

Change No. 2: To overcome the warpage fault particularly, and partially to secure sounder castings, a change was made to plaster mold castings.

After developing techniques for casting a piece of this size sufficiently flat (the plate is 10" x 18") the foundry, Hale Foundry Co., has been able to cut rejects from all sources to less than 5 percent.

To finish the piece, only a light surface grind is now required. Over the entire 18" length, flatness is held to a total variation of 1/64" and the thickness of the pads is held to a total of 0.015. With this accuracy as a starting point, the carriage plates can then be machined to have a total flatness variation of 0.001 and parallelism of the pads is also held to 0.001.

Initial cost of the plaster mold casting is about twice that of a sand casting, but machining costs have been reduced by more than 85 percent so that there is an over-all net saving on the finished part.

Early in the use of the plaster mold castings it was found that the particular alloy used would age at room temperature and that some warpage occurred after machining. This problem has been successfully overcome by artificial aging by the foundry. For the alloy used, ASTM SC64C, the most desrable heat treatment was found to be an eight-hour soak at 350F followed by air cooling. Since this treatment has been in use there has been no trouble due to room temperature aging.

From 2-Piece to 1-Piece

Similar considerations influenced progression from fully machined tool and jig plate, to sand casting, to plaster mold casting for the combination plate and film holder, Figure 2. This unit is carried by and rides on the carriage plate described above.

In each of the first two manufacturing methods, it was impractical to combine the units into a single holder, so that separate holders for plates and films were necessary. Furthermore, warpage problems and excessive machining were handicaps encountered in the sand cast piece.

The change to plaster mold casting permits combining the plate holder and film holder into a single, one-piece unit with surfaces that are so accurate that all machining except light grinding are eliminated.

These two features: reduced machining and simplified design have cut cost, more than 90 percent.

A factor that led originally to a large number of rejected castings on the plate holder was associated with small core shifts. On the small lip provided on each side of the opening, both the depth below the finished surface and the width are critical: the depth because it determines the final position of the photographic plate and the width because the lip must carry a number of leaf springs, each 3/16" wide.

A slight lateral shift of the core frequently left one lip too narrow to carry springs and a vertical shift threw the plate out of alignment with the finished surface. As sand cast, it was always necessary to machine this lip. With plaster mold castings, however, a technique has been developed for securing the cores in the core

Continued on next page

Another tough parts problem solved

by VACUUM DIE CASTING

of Silicon Bronze

Part: Pump Impellers
Mfgr: The Country's Top Pump Companies

Impellers Shown 3½" to 12" Diameter

One of the most important factors responsible for efficient pump operation and performance is the impeller. The material must be corrosion resistant to assure long trouble-free operation. Dynamic and hydro-dynamic balance are vital, and from a production-cost standpoint must be achieved with a minimum of time consuming machining. Dimensional consistency, too, is important for top performance. Here's why many of the outstanding pump manufacturers in the country have turned to Aurora Metal Company for their impeller needs.

METALLURGICAL ADVANTAGES

The AUR-O-MET silicon bronze alloy provides the extremely important corrosion and abrasion resistance. The vacuum die casting process provides even further wear resistance because of added density, increased strength and structural uniformity.

ENGINEERING ADVANTAGES

The combination of the exclusive die casting process, precision steel dies and special sand cores give greater casting control. This makes possible waterway smoothness unparalleled in the industry, and clean, sharp vane tips at inlet and exit openings for increased pumping efficiency

COST SAVING ADVANTAGES

The as-cast precision tolerances and structural uniformity reduces to a minimum or completely eliminates machine operations required for final balancing. Other machine operations are reduced to only those necessary for close running fit at the hub and the center hole to receive the motor shaft.

If you have a "tough parts problem," vacuum die casting of an AUR-O-MET alloy may be your answer.

A vast array of tough parts problems in many industries have been solved by the combination of AUR-O-MET alloys, the exclusive vacuum die casting process and the special sand cores developed by Aurora Metal Company. If you have a specific problem, the extensive experience of our engineering and production staff is at your disposal. Send prints, or specifications . . . we will give them our prompt attention.

Learn more about vacuum die casting in aluminum bronze. Send today for this free informative brochure.

AUR-O-MET ALLOYS

Aurora Metal Company

DEPARTMENT O AURORA, ILLINOIS

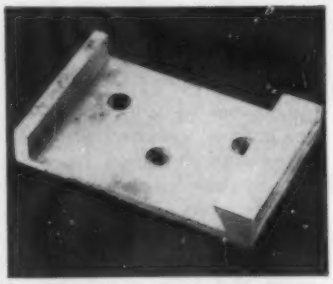
Representatives in: New York City, Rochester, Cleveland, Cincinnati, Detroit, Grand Rapids, Chicago, Minneapolis, Los Angeles, Boston, Seattle.

For more information circle No. 7 on the Reader Service Card

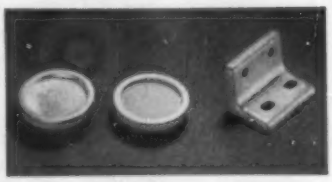
prints to cast the lip with sufficient accuracy to eliminate machining.

The Petri Stand base, Figure 3, was originally machined from aluminum plate. The high percentage of waste is evident.

The method of manufacture was then changed to sand casting which was some improvement, but as-cast, the dove-tail still had to be machined and the three holes drilled and



3. EVEN THE DOVETAIL of this Petri Stand base is cast to size by plaster mold casting. No machining is required.



4. SIMPLE SHAPES such as these hand wheels and optical bench adapter are less expensive than sand castings when surface finish must be good.

counterbored. Now the base is a plaster mold casting and requires no machining at all other than to remove an occasional burr, flash or parting line.

Cost reduction by changing to the plaster mold casting has been about 75 or 80 percent.

The hand wheel and optical bench adapter shown in Figure 4 are original plaster mold designs. No other method of manufacture has been used since older equipment did not carry comparable parts.

The hand wheel requires only minimal machining, the gate is cut off and three holes

Continued on page 65

A REALISTIC APPROACH for the product designer, in specifying design dimensions for investment castings, starts with an understanding of the influence of each step in the investment casting process upon dimensional control of the end product. Here, for the designer, is an outline of . . .

Dimensional Control of Investment Castings

By EDWIN G. CHAPMAN
Misco Precision Casting Co.

ONE of the prime advantages of the investment casting process has been the production of close tolerance, dimensionally controlled castings. This dimensional control advantage created considerable interest among potential consumers in general at the inception of its development. This tremendous enthusiasm resulted in investment casting business, which ultimately did the industry harm.

Early claims of dimensional tolerances of ±.001 per linear inch and cast finishes of 10-25 RMS were commonly made and were accepted by American industry as authentic.

More and more parts came off the drawing boards with tolerances based on the initial claims of our industry and as these parts were run in production quantities, enthusiasm gave way to the cold reality that the process had been oversold. We could not hold ±.001 tolerance except by selective inspection and this would, of course, directly reflect itself in casting prices. We could achieve a 10-25 RMS surface finish only with expensive operations which were not representative of the process.

The investment casting industry was faced with the problem of unselling overenthusiastic claims that had been made, and reselling the process again on a more practical plane. Unfortunately, in some cases, nearly irreparable damage had been done and some companies, because of the industry's initial failure to deliver, have never been resold on the process.

Now when the principal products were industrial castings, dimensional control was somewhat of a problem, but when the industry began producing aircraft quality castings on a large scale, the problem was magnified many times. Not only did the castings generally run larger in size, but the tolerances proportionally closer.

In addition, the difficult airfoil forms with their close envelope bands created entirely new problems. Contours were checked by optical comparator, guillotine gauges, air gauges and various other checking devices. Blade and vane throatal openings were measured to gauge points that, in some cases, could be picked up only by gauges and then in relation to a two, three or four point contour pickup on the airfoil. Here we were faced with generally closer tolerances compounded by forms that could not be checked by regular linear measurement.

At the same time, industrial castings became more complex. We were faced with the production of complex mold, with

Continued next page

Recommended dimension to tolerance ratio:

A tabulation of tolerances recommended by the writer on the basis of company experience, includes:

± .003 for dimensions .00 to .25
± .004 for dimensions .25 to .50
± .005 for dimensions .50 to 1.00
± .005/inch for each linear inch over 1.00

The .005 per inch tolerance cannot be made a hard and fast rule, because in larger castings, accumulated tolerances might cause a span that is unacceptable to a customer. This variation must be arrived at so that it is not only satisfactory to the customer, but is practical also for the foundry.

Dimensional Control—Cont.

intricate coring and multiple parting, all of which complicate the dimensional control problem.

The industry had passed from the "cast, cutoff, sprue grind and ship" era. No longer did a correct master pattern or injection die insure dimensionally acceptable castings. In virtually every phase of the process, factors heretofore unimportant created brand new problems.

It is with these factors that we must deal to operate a successful business and they must be dealt with in the successive order in which they are encountered in the process.

The Master Pattern

Basically, all dimensional control must start with the master pattern itself. Proper incorporation of shrink allowances is of the utmost importance, particularly in larger patterns. In order to achieve this, every company must have accurate information regarding shrink factors for all metals commonly used in their process. Misco has accomplished this by use of a specially designed specimen incorporating various measurable dimensions and simulating the volumetric and linear variations of an average airfoil section.

By running a number of these test specimens at different times, we covered the normal process variations in wax temperature, investment gelation time, etc. Master pattern to wax shrinkage and wax to metal shrinkage were then recorded and averaged out over the number of test specimens involved. The shrinkage factor thus resolved would cover all normal process variations and would produce castings within accepted tolerance ranges.

Once the shrink factor has been positively established, a projected master pattern must be studied to determine any unusual features that might tend to vary the normal shrinkage factors:

(a) Heavy sections in a part which produce localized shrink or cavitation in the wax pattern that is unacceptable: In these cases, it is necessary either to core or "chill" the section to reduce the shrinkage. Since the incorporation of a core or chill will greatly change the volumetric and linear shrink, it must be considered in arriving at the master pattern dimension for that particular section.

(b) Parting line location in critical tolerance sections: Since it is virtually impossible to remove these parting lines by manual means without also removing surrounding material and reducing the dimensions, here again compensation must be made to allow for this stock removal.

(c) Overhanging sections, such as blade shrouds and buttresses: Sections such as these will tend to restrict shrinkage both in the wax pattern and the casting. Here again it is essential that each company have accurate information as to the

Continued on page 66

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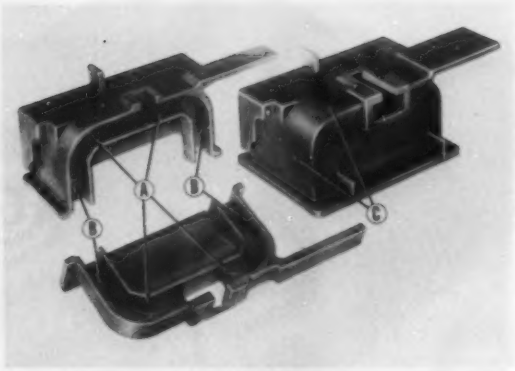
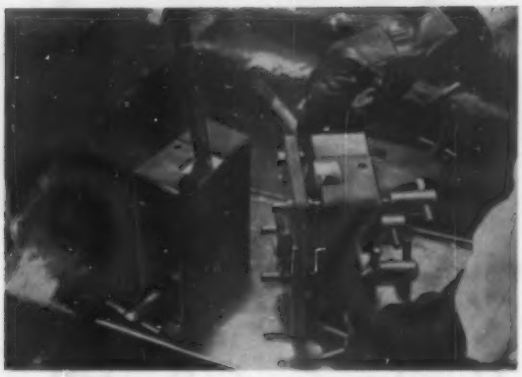


1. INSIDE DETAILS that would be impossible to machine are indicated by "A" and "B", while parting line is shown at "C".



2. BOOKING is illustrated, as matchplate is removed from the steel die holding two halves of a frozen mercury pattern.

Booking May Give You That Close Inside Finish

BY IRVIN R. KRAMER
Vice President, Mercast Corp.

How would you produce a component requiring tolerances of ±.003 and 63 rms microfinish on interior surfaces that are not accessible for machining?

This difficult problem is being solved on a production basis by the Mercast process which is investment casting technique using frozen mercury patterns.

The fact that frozen mercury patterns "weld" together upon contact, makes it possible to build up large, intricate, monolithic patterns with smooth, accurate surfaces, inside and out. These patterns are then invested (coated) with ceramic material to produce a refractory mold, after which the mercury is melted out, leaving a mold cavity of heat-resisting ceramic material into which metal can be poured.

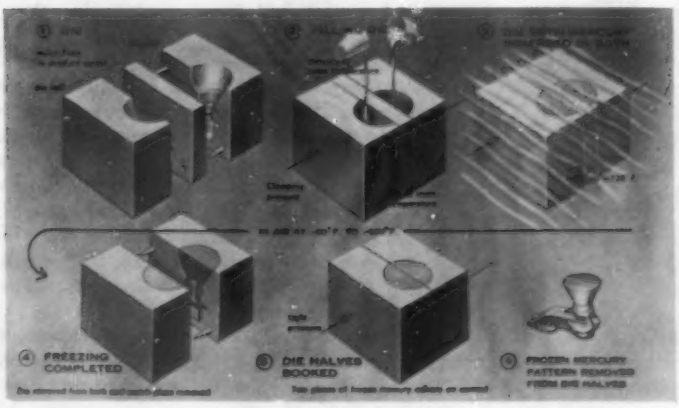
The process, Fig. 3, known as "booking", permits the production of undercut interior sections which could not be obtained in a one-piece casting made by any other process.

The component mentioned above, having extremely close internal tolerances, is a wave guide, Figure 1, used in airborne electronic equipment. It is cast in 88-8-0-4 bronze by Alloy Precision Castings Co., using booked patterns, Figure 2.

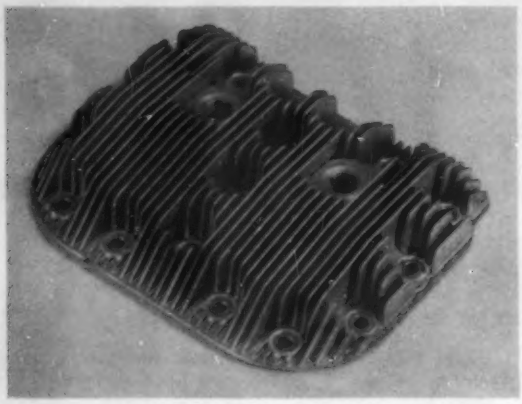
The interior of the guide is the critical area, with a tolerance required in this area of plus or minus .003. Since these surfaces could not be reached for machining, and must be used as cast, both dimensioial accuracy and smooth surface finish are vital. Accordingly, a 63-micro finish is achieved on the inside guide section (shown as "A" in Figure 1). Of additional interest are the "iris" sections also cast into the piece ("B" in Figure 1).

The wave guide, which weighs 1⅜ lbs. and is cast in 88-8-0-4 Bronze, is produced in two dies, with the frozen patterns booked prior to investment. The part is booked down the center line ("C" in Figure 1). Both the dimensional and finish control is maintained across the booking line. This unique feature of the frozen mercury process permits a part to be booked and still hold dimensional and finish tolerance across the booking line.

3. STEP-BY-STEP drawing depicts the booking process which is unique with Mercast investment casting.



5% More Power . . . Thanks To A Cool Head



By **F. B. ESTY,** Assistant Chief Engineer
Wisconsin Motors, Inc.

MANY factors can influence the horsepower output of a gasoline engine of a fixed bore and stroke. Two of these are the compression ratio and the operating temperature. Through the use of the proper materials and by good design, it is possible to increase the compression ratio materially and lower the operating temperature, both of which will increase the power output.

In the small engines manufactured by Wisconsin Motors, Inc. (these engines run from four to 36 horsepower, in single, two and four cylinder units) well-designed aluminum cylinder heads have accomplished both desired results.

Because these engines must operate on all commercially available fuels, the compression ratio is, of necessity, rather low to handle the low octane number fuels. Further, some of the fuels and their combustion products tend to be highly corrosive.

In order to provide the greatest amount of cooling and corrosion resistance in an air cooled engine, it is desirable to use a finned aluminum cylinder head. However, through the use of such a head, the problem of adequate material strength comes up, unless the amount of metal is made excessive. This strength factor requires that the fins act, not only as heat dissipating members, but also as stiffening.

The first aluminum heads designed were sand castings. The limitations of this fabricating method precluded section thicknesses as small as were desirable and further required greater spacing between the fins than good design dictated. However, the sand cast aluminum heads were successful and demonstrated that they were highly practical.

As an improvement over the sand castings, a change in fabricating method to permanent mold castings was made. By this process, somewhat thinner fin sections could be made and the spacing between the fins was reduced. These improvements allowed greater heat dissipation with consequent lowering in the engine operating temperature and a corresponding increase in power output.

The ultimate aim, however, of securing a head of adequate strength so that the compression ratio could be increased was not possible with a permanent mold cast head and, hence, the fabricating process was again changed.

When all design and fabricating factors were considered it seemed that a die cast aluminum cylinder head would probably be the best answer to the problem of increased power for a unit of fixed size.

The particular advantages of a die casting were the thinner fins that could be cast and the smaller space between fins that would be possible. Through the use of more and thinner fins, a much greater heat dissipation would be achieved. This allowed the compression ratio of the engine to be increased from 4.5 to 5.5 to 1. The higher heat generated was handled adequately by the increased radiating surface.

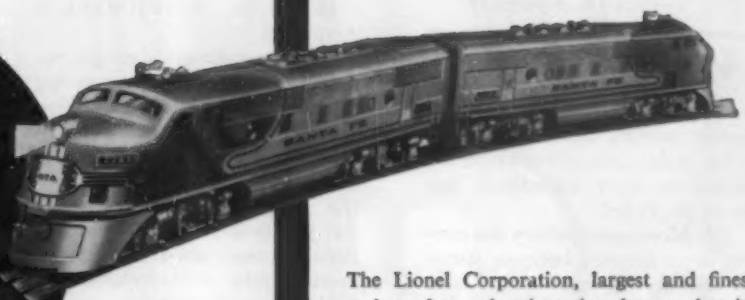
The higher compression ratio quite naturally induced higher stresses in the head. If the head were operated at the same temperature as before, it would have failed, but because of the greater heat dissipation possible with a die cast construction, the actual operating temperature of the head was lower than before and, hence, stronger.

The net result of a change to a die cast aluminum cylinder head was an increase in the power output of 5 percent without any structural changes in the engine.

The factors noted above were, of course, the principal reasons for converting to a die cast

Continued on page 59

Beautiful— but tough to build...so



Lionel chose **Kux** Die casting machines

to get perfect detail in its scale model trains

The Lionel Corporation, largest and finest maker of toy electric trains, knows that its customers require exactness of detail from gear boxes to the colors in the insignias of famous trains it reproduces. Much of this detail is possible only because of the perfection obtained by the use of die cast parts made on KUX machines. Lionel finishes must match those of the real life counterpart to the minutest detail . . . they have to be tough and durable enough to withstand the knocks of railroads operated by boys from "six to sixty."

KUX Die Casting Machines produce tough, smooth, non-porous castings that make these finishes possible. They add strength to the trains, provide superior performance, and permit an economy of production so Lionel can sell its products at the lowest possible price.

KUX engineers can help you solve equally tough production problems with exactly the right machine to meet your requirements . . . whether it's tiny gear boxes or gigantic castings. A letter or card will bring you full information.

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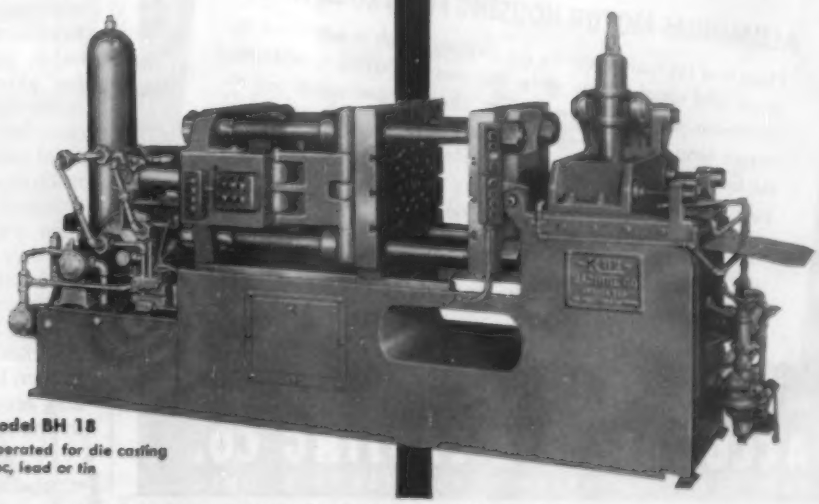

Model BH 18
Hydraulic operated for die casting zinc, lead or tin

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MAGNESIUM DIE CASTINGS
continued from page 38

and greater casting accuracy across parting line.

11. Adequate clearance for slides in four directions has been provided.

12. More satisfactory die cavity arrangement because sprue is usually in the center and often coincides with center of pressure created when the shot is made.

13. Tie bar adjustment is simplified.

14. Symmetrical design reduces likelihood of die opening during metal injection, helps maintain die thermal equilibrium.

According to Mr. Bennett, the magnesium hot chamber die yields a greater dollar return if constructed to suit the casting jobs contemplated. If built to cold chamber standards, it will be adequate for more production with reduced maintenance costs due to lighter pressures encountered.

The hot chamber machine is also reported to have certain limitations and unfavorable aspects. Purchase price is approximately 50 percent greater than for a cold chamber machine of equal clamp tonnage. Maintenance labor and materials costs appear to be in about the same ratio.

The machine is primarily designed for high volume, continous production and is not too well suited for one-shift use.

The present design is limited to alloys in the 6 to 11 percent aluminum range, and to castings with a two-pound maximum finished weight.

Higher Production Rates

According to Mr. Bennett, the advent of a faster-cycling hot chamber die casting machine makes it possible to take greater advantage of the properties of magnesium.

In recent years, he points out, quoted prices for magnesium cold chamber castings have been slightly higher in most cases than for the same parts in aluminum. This must mean that casters found higher magnesium production rates more than offset by metal losses and slightly lower casting efficiencies.

Magnesium requires less heat than aluminum per unit volume to melt, and conversely, magnesium castings during solidification give up only 20 Btu per cubic inch compared with 29 for aluminum, resulting in a faster casting rate. The hot chamber process, the Dow technical expert says, permits magnesium alloys to be cast at rates comparable with zinc, higher than aluminum.

Other factors to be considered, include: 1) High casting efficiency reduces inspection costs to a significant degree. 2) Hot chamber castings are easier to trim because of the light gate and accuracy with which they fit the trimming fixture.

*U.S. patent #2,660,769.

Light and Tough
FOR HEAVY DUTY SERVICE
ALUMINUM MOTOR HOUSING FOR TRUCK AXLES
Here is a typical Accurate die casting which is subjected to strain and rough usage under adverse operating conditions. Minimum weight and maximum strength are combined to assure long life and top performance in this motor housing for Eaton's Famous 2-speed axle Electric Shift. You too may be able to save time and money and get the production you need when you want it with an "Accurate" die casting.
Bring your design and production problems to our Engineers. Write or wire today for prompt service.
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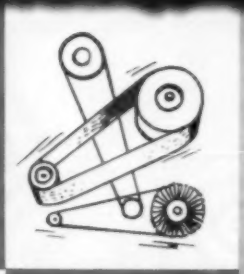
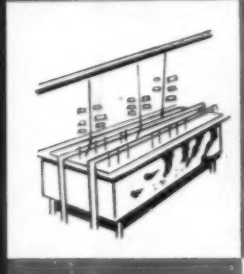
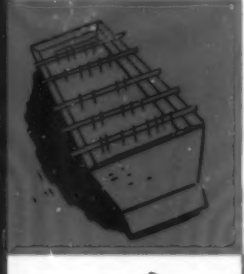






PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

devoted to the specialized problems of finishing . . .

DIE CASTINGS • INVESTMENT CASTINGS • PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS • POWDER METAL PARTS • SHELL MOLD CASTINGS

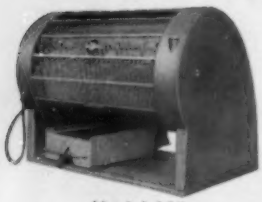
Come to TUMBLE GRAV-I-FLO FINISH

for higher lustre— smoother finish on metal parts

You can get a far superior finish on metal parts with the Super-Brite chips and compounds employed in the Grav-i-Flo Tumbling Process. Developed by originator of modern mechanical finishing, these materials also cut much faster, and eliminate the need of transferring parts from the cylinder between roughing and finishing operations. They likewise eliminate subsequent operations such as ball burnishing for color.

And, the time-saving Grav-i-Flo process for finishing and deburring cuts direct labor costs too. Hundreds of companies are getting better finishing and deburring results, faster and cheaper. If you haven't checked these advantages to your competitive position, do so today! Invite Grav-i-Flo to make recommendations.

Grav-i-Flo offers complete equipment, accessories and supplies for all your tumbling needs!



Model 66", two compartments

Model 48", two compartments

Machines. Grav-i-Flo 66", 48", 36", 32", and 24" machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.

Model 36", two compartments

Model 32", two compartments

Model 24", two compartments
Designed For Small Lot Production and Laboratory Processing.

Compounds. Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

Investigate. Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or you may send samples direct to us. Engineering Service available to all users.

SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

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☐ Send complete catalog. ☐ Have Sales Engineer call. ☐ We are sending samples.

Company_____

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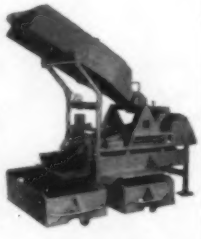
GRAV-I-FLO CORPORATION 400 Norwood Avenue Sturgis, Michigan

ACCESSORIES

Two deck parts-and-chips separator and chip grader.



Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

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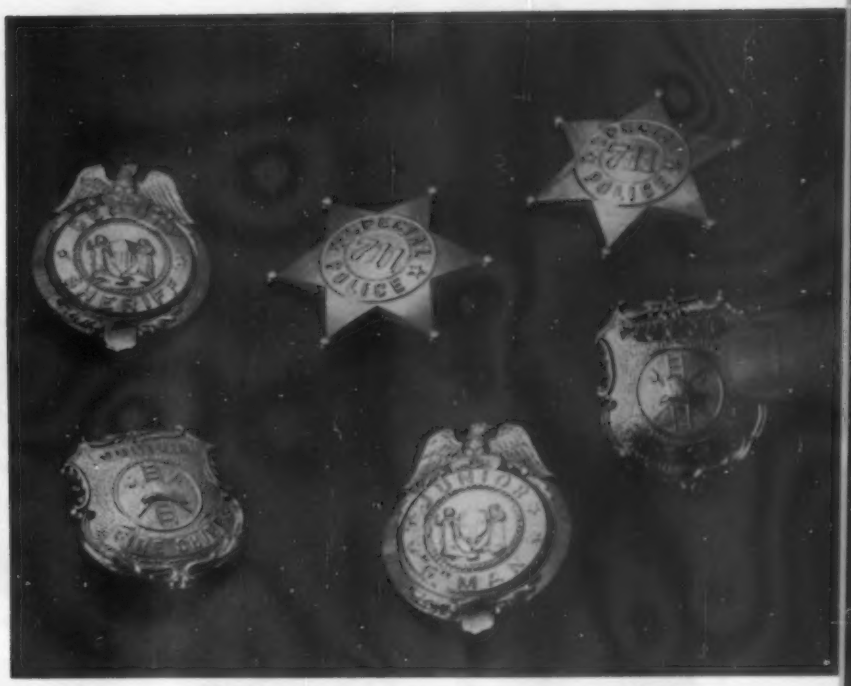
Dealer orders have proved to one toy-maker that . . .



SALES JUMPED a quarter of a million pieces when these badges, sporting a brilliant vacuum metallized coating, were displayed at a toy show last year. Vacuum coating on these, and other items illustrated, are applied by Vacumet, Inc.

Vacuum Coating Sparks Sales

WHAT can you do to pep up an item when it slows down going across the retail counter? Dowst Manufacturing Company, Chicago, had that problem last year.

Dowst has made a line of die cast zinc and lead base toys for more than 15 years. The sick chicken was their line of metal badges; after an aggregate sale of some ten million pieces, they seemed to have lost their appeal for the junior G-Man set.

Looking for merchandising medicine, Dowst took a sample run of zinc base badges and had them processed in both gold and silver tint finishes by vacuum coating at Vacumet, Inc., Chicago.

Test of the treatment came at last year's Toy Fair. Results? The badges—identical to the ones Dowst had made for 15 years, except for the vacuum-applied coating—pulled orders for a quarter of a million pieces at the show.

A complete recovery is assured, and the badges are back in production at a 50,000-per-day rate; present plans call for international distribution as part of Dowst's Tootsie Toy line. Dowst is also considering further use of vacuum metallized coatings to dress up other items in the line of miniature, die cast toys.

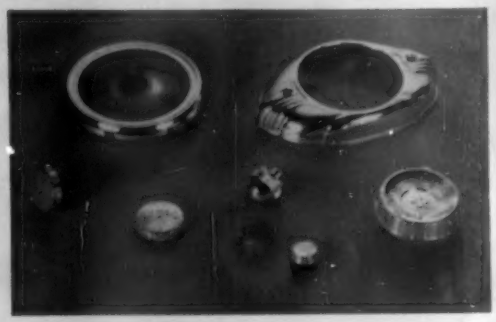
This example of the value of a bright, lustrous finish for moving merchandise in the toy and novelty field, brings up the question: why can't this type of vacuum coating be put to work on other die cast consumer items? The answer is, "They can and are . . ."

Vacuum coatings are now being used, or considered for use, on diverse types of die cast products. These items include: fishing rod handles and other sporting goods, garden tools, packaged retail hardware

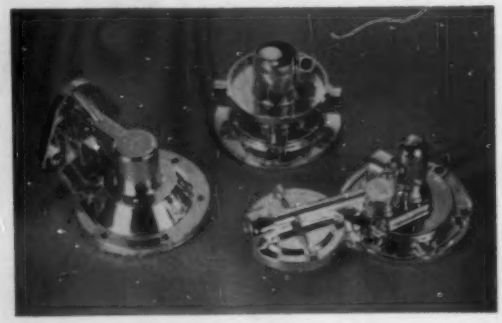
A thumb-nail guide to vacuum coating's applications — see next page

Can Your Product Be Vacuum Coated . . . ?

YES . . . if it is sold over the counter and needs point-of-sale sparkle; if it does not require resistance to abrasion or corrosion in use; if there is no step in handling, assembling or machining *after* vacuum coating which would tend to nick or scratch the surface; if its principal use is decorative rather than functional; if surfaces are reasonably free of blemishes as cast, or can be given some treatment such as fluting, to create highlights that mask minor blemishes.



Bezels, Knobs, Buttons, Etc.



Replacement Auto Parts

Fishing Rod Handles, Sporting Goods

Toys, Novelties, Premium Items

NO . . . if it is subjected to severe abrasion or corrosive service conditions; if some step in processing subsequent to coating would tend to mar or scratch the surface; if the shape of the part is such that surfaces to be coated could not be directly exposed to the vaporized metal.

items, drawer pulls, jewelry items, a variety of small knobs, dials and controls. They are likewise being studied for possible application on automotive interior trim, fuel pumps sold for replacement, nameplates, lighting fixtures, bezels, ferrules and many more products.

Some of these items are obviously utilitarian in purpose, but it is a well established fact that bright and colorful merchandise creates sales, even when the appearance of the item in actual usage is of no importance. One of the principal uses for vacuum coatings may be expected to be the enhancement of shelf-appeal of retail items.

A prime example of this might be the housing for a fuel pump, now being considered for vacuum coating with gold finish . . . this equipment, sold over the counter as a replacement item, needs no surface treatment for protection or appearance. In fact, it is hidden from view when it is installed. Yet, the golden sheen of the vacuum coated surface is expected to increase sales appeal of this item, as compared with the grayish color of an uncoated die cast fuel pump.

What is vacuum coating? Briefly, it is a vacuum-applied film of aluminum sandwiched between two layers of clear, baked lacquer or enamel. The metallic film duplicates the high gloss of the organic undercoating, thus giving the brightness of highly colored metal; serviceability of the coating is that of a baked organic finish and is, therefore, suitable wherever such finishes could normally be used. That is to say, it has the performance of an organic coating and the looks of a plated coating.

For additional decorative punch, the coating may be dyed in any of a variety of bright colors, gaining an appearance similar to that of color-anodized aluminum.

Economy of this type of finish stems from the fact that die castings generally have a good enough surface to be processed without expensive polishing or buffing; less skilled labor is required than for conventional electroplating; and there is less handling of parts from start to finish of the processing.

FRICTION MATERIALS
continued from page 32

inert material such as silicon dioxide or aluminum oxide is added to control the coefficient of friction.

The powder mixture is fed into dies as in normal powdered metal fabrication processes and the material pressed sufficiently to allow it to be handled and to secure the desired green density. Sintering is carried out in a reducing atmosphere.

Since many friction materials must be fastened to steel backing plates, the method of sintering varies from normal powder metallurgical practice. The pressed wafer is placed on a preformed steel plate and alternate layers of steel and powder compacts built up. The stack, so built, is placed in furnaces and sintered under pressure.

Where Are They Used and Why?

In 1931, development of a new bus for city transportation gave "metallics" their first opportunity to prove themselves in a commercial installation. The requirement for smooth engagement combined with the severe wear problem created by the frequent starting and stopping in this service had created a problem beyond the capabilities of organic linings available.

Actually the "metallics" were tried in desperation and solved the problem of smooth operation while outwearing the conventional linings by more than five to one, and allowed the overall size of the unit to be held to a reasonable size. (See Figure 2.)

This ability of the new metallic linings to "take it" and keep coming back for more soon made them the recognized material for rugged, heavy-duty jobs in a wide variety of applications. They were soon after tried in the braking field and, in the aircraft landing wheel application, scored one of their most brilliant successes. Here the problem was to find a brake lining that would stand up and perform consistently in applications where temperatures as high as 1200F where developed in the linings within a few seconds.

The field of application has now been expanded to include drive clutches and steering brakes for earth handling equipment, Figure 3, clutches for all kinds of fabricating ma-

Continued on next page

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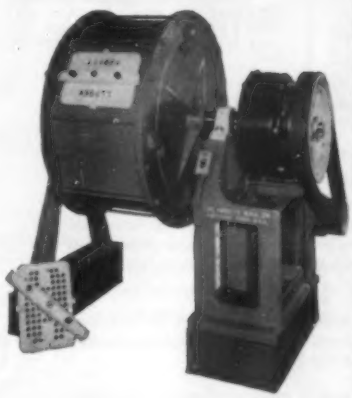

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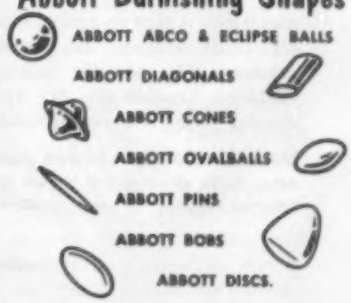

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chinery, Figures 3 and 4, and in multiple disc clutches for a wide variety of applications. One example of this use in multiple disc clutches is in the automatic transmission for automotive units, Figure 5.

The field of usefulness for "metallics" is by no means limited to heavy-duty applications. In the field of actuators, for vibration dampeners and a great number of widely varied torque-limiting applications, they are finding increasing usefulness. This is principally because of their inherent smoothness and uniformity of torque handling capacity.

They are essential in the aircraft field, because of their ability to provide almost absolute torque control over the required temperature range, while operating under high unit pressures, Figure 6.

In certain of the illustrations given above, the friction surfaces are run "dry" while in other cases they are run in oil. The "metallics" are inherently self-lubricating and may be operated entirely "dry" without scoring either their own or mating surfaces. However, because their "dry" coefficient of friction is materially higher than when run in oil, they should be run either 100 percent dry or completely in oil to avoid erratic performance.

When run in oil, spiral or other grooving in the lining is often required to facilitate removal of the bulk of lubricant more quickly during engagement of the friction surfaces. Such grooving can be furnished in a wide variety of patterns as indicated in several of the accompanying illustrations.

The field of applications of metallic friction materials is far wider than indicated by the few examples selected. In general, they may be considered wherever power is to be transmitted, stopped or controlled. The material is available in sizes ranging from tiny actuator, vibration dampeners and torque limiting clutches to the largest size clutch and brake units required for heavy duty equipment.

TABLE 1
Most Commonly Used Abrasives*

Metallic	Artificial	Natural	Agricultural
Chilled Cast Iron	Silicon Carbide	Garnet	Cocoanut Shells
Cast Steel	Aluminum Oxide	Quartz	Black Walnut Shells
Malleable Cast Iron	Glass Beads	Silica	Pecan Shells
Crushed Steel	Refractory Slag	Decomposed Rock (Novacite)	Peach Pit Shells
Cut Steel Wire	Rock Wool by-Products		Filbert Shells
Aluminum			Cherry Pit Shells
Brass Shot			Almond Shells
Copper Shot			Rice Hulls
			Ground Corncobs

*Each group listed in order of decreasing hardness

TABLE 2
Screen Aperture and Standard Screen Numbers

Screen Aperture In Inches	Screen Number For Grit	Screen Number For Shot
0.132		S-1320
0.0787	G-10	S-780
0.0394	G-18	
0.0331		S-330
0.0165	G-40	S-170
0.0070	G-80	S-70
0.0049	G-120	
0.0017	G-325	

How To Select Abrasives For Blast Cleaning

By VICTOR F. STINE
Vice President in Charge of Engineering
Pangborn Corporation

OF THE many types, sizes and shapes of abrasives available, there is always one which will blast clean a particular part better, faster and more economically than any other. Primary factors to be considered in selecting the correct abrasive for a particular job are: (1) the type of metal to be cleaned, (2) the shape of the part, (3) the kind of material to be removed, and (4) the surface finish desired.

Metals that are blast cleaned range from toughest armor plate and cast iron to soft aluminum alloy and vary in size from locomotives to dental drills. Surface coatings ranging from burnt-in sand to thin oil film can be blasted to produce effects ranging from deep abrading to gentle wiping. To cover this wide range of cleaning requirements, blasting equipment manufacturers have developed a nearly equally-wide range of abrasives.

The first step in choosing the correct abrasive is to find out what abrasive materials there are to choose from and the effects these materials have on the cleaning action.

The second step is to consider the shapes and sizes of the abrasive particles and the effect of particle dimensions on the cleaning action.

The third step is to consider what would be the cost (abrasives and labor) per square foot of cleaning. The cost factors would be: (a) the cost of abrasive, (b) time requirements, (c) the possibility of abrasive recovery, and (4) the cost of dust suppression.

What Abrasive Materials To Use

Abrasive materials fall into four groups: metals, chemical compounds, natural compounds and agricultural grits. The material determines the hardness, absorbing ability, cutting ability and deterioration tendencies of an individual particle.

The most commonly-used abrasives are listed in Table 1. The hardest material in each group is listed at the top of that group with the others following in order of decreasing hardness.

In general, these abrasives have the following hardnesses:

Metallic

Chilled Cast Iron
62 Rockwell C
Cast Steel
47 Rockwell C
Malleabrasive
37 Rockwell C

Artificial

Silicon Carbide
9.6 Moh's Scale
Aluminum Oxide
9.2 Moh's Scale

Natural

Garnet 8.0 Moh's Scale
Quartz 7.0 Moh's Scale
Silica 7.0 Moh's Scale

The hard abrasives cut deeper and faster than the others. For the reason chilled cast iron, malleable cast iron, and the natural abrasives are used for removing scale and burnt-in sand, and for knocking out cores from iron and steel castings.

In spite of the faster cleaning action of the hardest particles, only those soft enough not to embed in the metal should be

used. If the abrasive particles lodge in the work, they can possibly damage machine tools, and in the case of aluminum or brass will corrode the casting.

Abrasives softer than the metal they clean can remove material without substantially changing the dimensions of the metal. Even though nozzles are made of hard manganese alloy and boron carbide (said to be the hardest material known except diamond), prolonged flow of abrasive will wear them down. Softer abrasives wear nozzles less than do the others.

Agricultural abrasives serve particularly well in cleaning grease, oil, carbon, and similar material from finished parts and assembled equipment. Because the abrasives are often residues, they are much less expensive than petroleum-base solvents. The absorbing ability of the particles gives an effect similar to wiping. The most frequently-used abrasives are ground corncobs, small cubic hard-wood particles, and nut shell aggregates. Various degrees of abrasiveness can be obtained by mixing a soft agricultural grit with a harder one, usually rice hulls.

Four Types of Blast Units

The type of blasting equipment on hand influences the choice of abrasives. Four types of blasting are commonly used and can be designated by their propellant force, they are: (1) compressed air, (2) centrifugal, (3) high pressure water, and (4) a combination of compressed air and water.

Compressed Air:

(1) Uses any type of abrasive

(2) Blast pattern under close control

(3) By varying pressure or use of induction abrasive flow the blast intensity can be closely regulated. Equipment usually of simple construction and requires little maintenance.

(4) Possible to clean interior surfaces, chambers or holes, etc. The air stream removes the spent abrasives from the surface being impacted.

Centrifugal:

Most efficient with metallic abrasives. Requires less horsepower per pound of abrasive thrown.

High Pressure Water:

Uses sand abrasive. Removes sand cores and cleans surfaces at one operation. Dustless.

Compressed Air and Water:

Uses sand or natural abrasives of very fine grain size and produces smooth satin surface finish. Blast pattern under close control. Dustless.

Hydraulic equipment—which cleans by spraying the surface with abrasives suspended in water — uses aluminum oxide, quartz, silicon carbide, silica, and very fine-mesh natural abrasives (up to 5000 mesh). Agricultural abrasives in most instances require compressed-air blasters because individual particles are quite light. Air blasting uses chilled cast iron or sand for difficult jobs and malleable abrasive for lighter cleaning.

Particle Shape and Size

Most metallic abrasive particles can be classified as shot or grit. Shot is as nearly spherical as economy in manufacturing will allow. Grit is irregular and has many cutting edges. A few abrasives such as cylindrical cut wire and cubic hardwood particles do not fall into this classification.

Shot abrasive gives a peening effect. It hammers the metal, cracking and lifting the material to be removed. Grit both hammers and cuts the surface it is cleaning. Because of these differences in cleaning action, grit and shot are used for different applications. Basically, shot is used to remove foundry sand while grit is used for removing paint and rust and for preparing surfaces for further finishing.

When deciding on the abrasive size, consider the shapes of the metals to be cleaned. Because large shot ricochets when it strikes a surface, it is particularly good for cleaning intricate pieces. Large shot will bounce to hard-to-reach surfaces and will therefore do multiple cleaning before spending its energy.

Section thicknesses of the part being cleaned limit the size of the abrasive that should be used. Because larger particles are usually heavier, they develop greater kinetic energy, strike the surface with greater force, and peen the metal more vigorously. Heavy peening is very desirable in many cases. However, if the sections are thin the surface exposed to the barrage could possibly stretch enough to warp the sections.

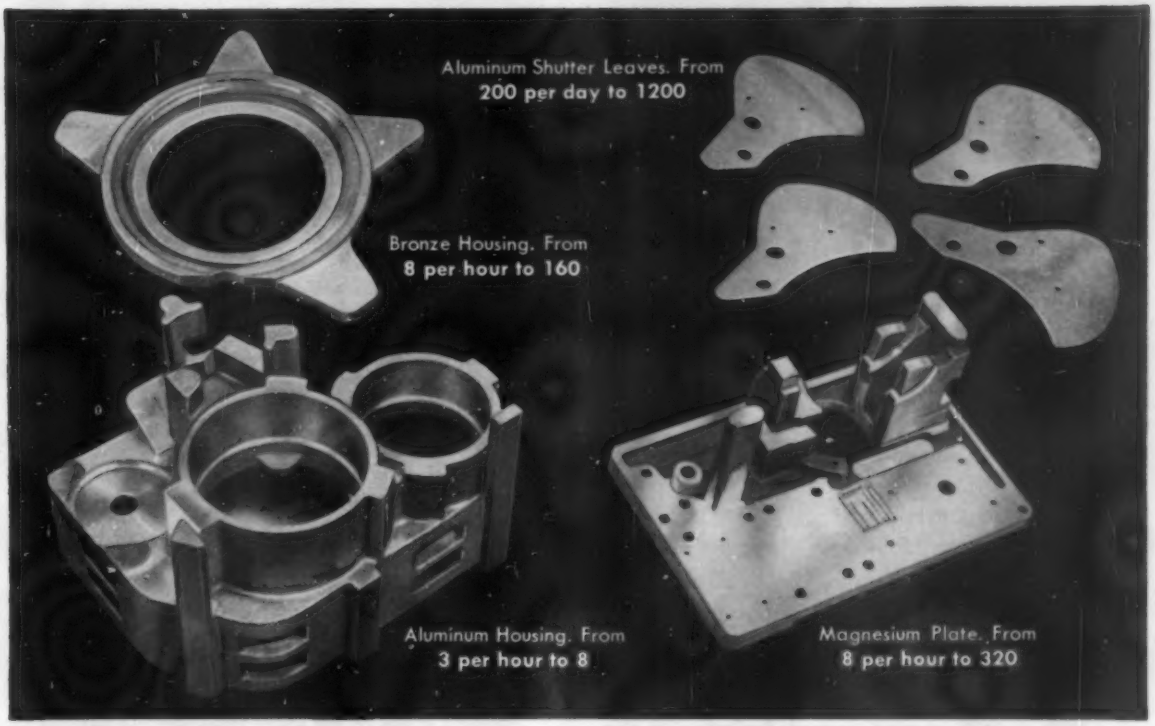
The size of abrasive particles govern the coverage provided by the bombarding stream. Smaller particles give more uniform coverage with more overlapping and less chance to miss part of the surface in a once-over-lightly blasting.

Particle dimensions also affect the surface finish provided by blast cleaning. Small particles give fine finished; large particles produce coarser finishes. Shot gives a smooth, minutely dented surface; grit gives a rough surface covered with very small irregular cuts.

Because of the irregular shape of grits it is difficult to specify their size. The A.S.T.M. has devised a system for measuring the size of both grits and shot, based on passing a sample of the abrasive through a series of screens with diminishing mesh sizes. Three screen sizes —the high screen limit, the low screen limit, and the nominal screen—indicate the size of the particles.

The high screen limit is the size of the smallest screen which is too large to retain any of the sample. The low screen limit is the size of the largest screen which is too small to pass more than a given percentage of the sample. Percentages range from 5 to 25 percent for shot and 10 to 35 percent for grits. The nominal screen is the largest one which will retain a large percentage

Continued on page 82


Aluminum Shutter Leaves. From
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Bronze Housing. From
8 per hour to 160
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3 per hour to 8
Magnesium Plate. From
8 per hour to 320

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PROCESSES

Investment Cast Parts: 144

Kolcast Industries, Inc. has issued a new brochure describing the frozen mercury pattern process of investment casting and showing some of the parts that can be cast by this process only.

Shell Molded Castings: 145

The applicability of the shell molding process to the production of intricate as well as simple stainless steel castings is discussed in a recent issue of the Cooper Alloy Newscast. Properties of cast stainless steel, design considerations, etc. are covered.

Zinc Die Castings: 146

A group of interesting case histories showing the wide diversity of products made basically with zinc die castings are given in a recent issue of The Alloy Pot, published by the New Jersey Zinc Co.

Powdered Metal Parts: 147

The Amplex Div. of the Chrysler Corp. has issued a brochure describing the properties of "Steel Oilite". A number of typical uses are shown and the average physical properties of the material detailed.

Investment Castings: 148

How the use of an investment casting allowed the production of an intricate valve is discussed in the December issue of the Haynes Alloys Digest, published by the Haynes Stellite Co.

MATERIALS AND EQUIPMENT

Ethyl Silicate: 151

Anderson Laboratories, Inc. have issued a complete catalog of the products of that company, including ethyl silicate used in investment casting. Physical properties and prices are listed.

Die Casting Machine: 152

A completely new line of hot chamber and cold chamber die casting machines in from 200 to 1000 tons pressure are described in a brochure that has been issued by Hydraulic Press Mfg. Co.

Powdered Metal Press: 153

A brochure describing a complete line of forming presses ranging from 50 to 500 tons capacity is available from the Kux Machine Co.

Melting Stock For Investment Casting: 154

Precisely prepared melting stock, specifically for the investment casting industry, is described and the compositions of a few of the alloys available given, in a pamphlet from Michigan Steel Casting Co.

Case Hardening Compound: 155

"How To Case-Harden Tools" is the title of a pamphlet describing Royal hardening powder. The folder has been published by the Anti-Borax Compound Co.

Pantograph Engraver: 156

A new brochure, available from the Green Instrument Co., describes in detail the new Green Model D-2 heavy-duty pantograph engraver.

Small Parts Catalog: 157

Gries Reproducer Corp. has issued a new catalog showing a few of the many small zinc die castings made by that company as a standard line of products.

Pyrometry: 158

Reprints of an article "Notes on Pyrometry" can be secured from the Tempil Corp. The various types and accuracy of different methods of temperature measurement are discussed.

Air Control Units: 159

Bulletin AV300R, published by the Bellows Co., illustrates and describes the Bellows Electroaire Valve. Installation photos, dimensional drawings and specifications are included.

Thermocouple Elements: 160

A new bulletin illustrating and describing its line of Serv-Rite thermocouple elements and bare thermocouple wire has been issued by the Claud S. Gordon Co.

Die & Mold Finishing: 161

"How to Cut Die and Mold Finishing Time 50% to 90%" is the title of a new bulletin published by American Wheelabrator & Euipment Corp.

Carbon & Alloy Steel Drill Rod: 162

A new descriptive bulletin on high speed, carbon and alloy steel drill rod has been published by the Allegheny Ludlum Steel Corp. The leaflet gives grades, lengths, sizes, finishes and tolerances. Detailed chemistry is also included.

Air Gauge Reconditioning Service: 163

To keep air gauges in the best operating condition, the Freeland Gauge Co. has instituted an air gauging member reconditioning service. A complete description of this service is in a brochure recently published by the company.

Automatic Temperature Control: 164
Automatic temperature control for induction heating is the subject of bulletin HT-1 from Minneapolis-Honeywell Regulator Co., Industrial Div. The bulletin is a thoroughly documented engineering report on the subject.

Molybdenum Disulfide Lubricant: 165
The importance of fine particle size is graphically represented in a leaflet on molybdenum disulfide lubricant that has been issued by the Alpha Corp.

Test Bar Theory & Practice: 166
Written from a foundryman's point of view and aimed specifically at the aluminum and brass foundries, a new 18-page bulletin entitled "Test Bars" is ready for distribution from the Federated Metals Div. of American Smelting & Refining Co.

Grinding Wheels: 167
A new brochure "V40 for Tool Room Grinding" has been published by the Carborundum Co. The booklet describes a completely new line of tool room wheels and lists hints for conservation of tools.

Machine Deburring: 168
A leaflet issued by the Nobur Mfg. Co. describes their power driven deburring tools for both inside and outside work. A noburr countersink is also described.

Automatic Drill Unit: 169
An automatic drill unit adaptable to either single or mutliple installation is described in a brochure issued by Dumore Precision Tools. The unit is said to feature built-in controls for manual, semi-automatic or fully automatic operation.

Plated Die Castings: 170
A description of the plating installation in one large die casting plant is given in a recent issue of the Unichrome Observer, published by United Chromium, Inc.

Finishing File Data: 171
A comprehensive fact file on chromate conversion coatings has been issued by Allied Research Products, Inc. Included are sheets on ARP chemicals and brighteners for zinc and cadmium plates.

COOLER HEAD—MORE POWER

continued from page 46

cylinder head. Along with the change, however, came other advantages. The amount of machining necessary to prepare the casting was sharply reduced. In every place, the as-cast surface is adequate for use except at the gasketed face.

All of the bolt holes and the two spark plug holes were cored in the casting. As the head is received from the die caster, the two plug holes must be tapped and one surface faced. Occasional deburring is also necessary.

The reduced machining costs coupled with the lower unit cost made possible by mass production methods has resulted in a cylinder head that is probably somewhat less costly, when ready for assembly, than any of the previous heads made by different fabricating methods.

Look alike? Yes! — but what a difference in finishing costs. It cost a plumbing fixture manufacturer only $.0104 to finish the part on the right by Supersheen Speed Finishing. The part on the left cost $.25 to finish by former costly hand finishing methods. That's a saving of over 95% or $4,792.00 for 20,000 units. Supersheened finished parts maintained a much greater uniformity too.

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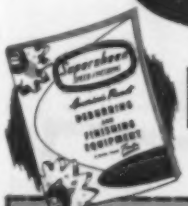

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A recent survey of plants throughout the nation using rectifiers for DC conversion revealed that SEL-REX units were building up the greatest records in efficiency and dependability.

SEL-REX places no limitation on engineering to achieve the finest DC power plant . . . nor compromise in the choice of components to "bring the cost down". True, such a policy may reflect a slightly higher initial cost . . . but in the long run, a SEL-REX is the most economical. There are no moving parts to wear out, no maintenance expense, no loss of production.

SEL-REX RECTIFIERS are available for every requirement from 25 to 50,000 amperes in completely sealed water cooled or air cooled models.

Write Dept. PM-1 for complete details.

NEMA

BART-MESSING CORPORATION
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For more information circle No. 87 on the Reader Service Card

PRODUCT NEWS AND DEVELOPMENTS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

HIGH VACUUM MELTING FURNACE
. . . for from 5 to 50 pound charges

A high vacuum melting and casting furnace with a capacity of from 5 to 50 pounds per charge has just been introduced. This laboratory furnace is designed to meet the increasing need of metals producers to investigate the effect of high vacuum processing on old and new alloys with particular emphasis on the high temperature alloys now in great demand by aircraft engine manufacturers.

Large vacuum pumping capacity is provided by the CVC type KS-600 two stage diffusion-ejector pump which creates the low pressure (of the order of 10^{-4}mm Hg) required for a gas free atmosphere and provides ample capacity (up to 0.75 mm Hg) for handling the pressure surges that occur during alloy additions and pouring.

Consolidated Vacuum Corp.
For more information, circle No. 201 on the Reader Service Card

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DEBURRING TOOL
. . . saves reversing work

To deburr the top and bottom of a hole, the work must generally be reversed. Now a tool manufacturer has put a new deburring tool on the market that does both of these deburring operations without moving the work.

The new tool can be used in automatic single or multiple spindle machines or, where production does not warrant automatics, hand power-equipment can be used.

A simple adjustment is said to prefit blade pressure to the size of the chamfer required. The tool is then fed in and out of the hole without reversing the part.

Cogsdill Tool Products, Inc.
For more information, circle No. 202 on the Reader Service Card

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HOSE COUPLING
. . . for heavy surge applications

A new series of hydraulic couplings, designated as "H" series has been introduced. The coupling is available in sizes from ⅛" to 10" ID.

New design features are said to make the coupling suitable for higher pressure and heavier surge applications than ever before possible. The metal-to-metal valve stop in the closed position permits positive control of the compression of the valve washer sealing member regardless of the surge or pressure build-up in the line. The length of the valve washer life is reported to be increased considerably because it is never overcompressed or placed in shear.

Alloy steel of high tensile strength is standard material in the "H" series couplings—however, they can also be made in a variety of stainless steels and non-ferrous materials to meet unusual conditions.

The new couplings retain the proven design features of the recently introduced "Hi-Flow" line such as smallest coupling dimensionally, size for size of any coupling, and the highest rate of flow with less pressure drop.

Snap-Tite, Inc.
For more information, circle No. 207 on the Reader Service Card

Continued on page 63

UNICHROME

News about

COATINGS for METALS

Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Easy change expands chromium plating capacity of existing equipment

THE WAY TO CUT RACK COATING EXPENSE

Plastisol rack coating builds up substantial body and resiliency and offers longest service. Also easier and more economical to apply, it provides a positive means for lowering rack insulation and maintenance costs.

In its many years of use, plastisol Unichrome Coating 218X has established a remarkable record for economy. It defies all plating and cleaning solutions, even vapor degreasing cycles.

Bright zinc finish features both quality and economy

With the pressure on to cut costs in every possible way, it pays to take another look at economical chromate finishing.

When processed in Unichrome Clear Dip, zinc plated castings get a finish with brilliance similar to chromium. They're also made corrosion resistant. Topped with one of the time-tested, uniquely durable Unichrome Clear Organic Coatings, such products meet high standards of quality and can deliver a long, attractive service life.

HELPFUL HINTS

by "Mr. Cost Cutter"

For true economy in an organic finish, base your specifications on both quality and applied cost—rather than on misleading cost-per-gallon. Consider 3 flat black finishes for wrought iron, for example:

	applied cost/sq. ft.
Coating "A"	1.2 to 1.3¢
Coating "B"	0.8 to 0.9¢
Coating "C"	0.8 to 0.9¢

A Unichrome epoxy resin type finish, Coating "C" sells for twice as much per gallon as the other two, yet it not only gives best "mileage" but also a better looking, more durable and corrosion resistant finish.

UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.

In Canada:
United Chromium Limited, Toronto 1, Ont.

Plant switching to Unichrome SRHS Chromium Solution increases output 66% — slashes rejects, saves power

The experience of a well known plant exemplifies one of the easiest, most economical and successful ways to "expand" a chromium plating department, or reduce its operating costs.

With the ordinary chromium bath, tank load was limited to only *six* bumpers because of current supply and coverage problems. Even at this rate, rejects due to coverage failures were running high.

Changing the bath to Unichrome SRHS Solution worked wonders. Results with this up-to-date bath were actually better—and cheaper, of course—than *physically* expanding this plant's capacity. *Ten* bumpers could be plated per cycle—a 66% increase in output. Coverage improved so strikingly that rejects dropped drastically.

ADVANTAGES CONFIRMED

This is no isolated case of improvement in operations. Many reports verify that Unichrome SRHS Chromium Solutions provide new economy in plating, better coverage and increased productive capacity.

For example: SRHS increased bumper plating 33% at another plant. . . . It reduced bath upkeep costs 40% for still another user. . . . It hard plated work formerly requiring 3½ to 4 hours in only 2½, producing fewer rejects and substantial savings in grinding time as well.

Simply by making up self regulating high speed Unichrome Chromium Plating solution, tanks used formerly for the ordinary solution can do more work.

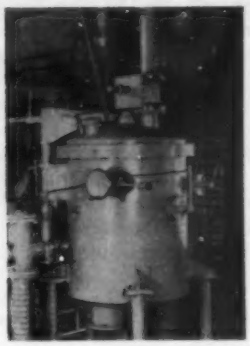
EASY OPERATION

Because important constituents of Unichrome SRHS Baths are automatically controlled, operation is easy and dependable. The SRHS wide bright plate range avoids "burns" and "misses" on the work. These and other advantages are more fully discussed in Bulletin SRHS-2. Send for it.

For more information circle No. 78 on the Reader Service Card

NEW PRODUCTS—cont.

VACUUM FURNACE
. . . induction heated



A new 30-pound induction-heated vacuum furnace is now being marketed. Available with either a vertical or horizontal shell, it is a completely self-contained versatile furnace for research and development purposes. Among its unique features are a co-axial power feed-through and means for adding additional charge material or alloying material during melting without losing the vacuum.

Naresco Equipment Corp.
For more information, circle No. 200 on the Reader Service Card

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OFFSET BORING HEAD
. . . for light and medium precision boring

A new offset boring head has been developed to fill the need for a light and medium duty tool that could be relied upon for precision boring, facing, and threading operations. The Mico Head is adaptable to a wide variety of applications through the use of interchangeable shanks that are available. The compact symmetrical design with minimum overhang of the tool-holding slide bar results in greater accuracy and longer life.

The tool is fitted with a micrometer style adjusting collar with widely spaced graduations permitting rapid and accurate direct reading adjustments. One complete revolution of the collar moves the tool holding slide bar 0.050 radially.

Mico Instrument Co.
For more information, circle No. 205 on the Reader Service Card

RELEASE AGENT
. . . for shell molds

A new shell mold release agent, designated as SR-20, has recently been introduced in the United States and Canada.

The new material is said to be used in small enough quantities to reduce the cost of silicone required for shell molding.

The SR-20 shell release emulsion is for routine, continous use in releasing shells during shell mold production. The emulsion may be diluted with about ten parts of water and may be applied by spraying.

Shellway Corp.
For more information, circle No. 199 on the Reader Service Card

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HYDRAULIC COUPLINGS
. . . for medium & high pressure

A new line of hydraulic hose and couplings, tradenamed "Surgepruf", for medium-high and high pressure service has been introduced. The couplings, manufactured to J.I.C. stand-

it's the FINISH that counts
. . . and when it comes to finishing die castings, you can count on us
We make a specialty of plating zinc die castings on a production basis. We have completely automatic plating facilities suitable for long runs. We have more than 34 years of experience.
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FPCo
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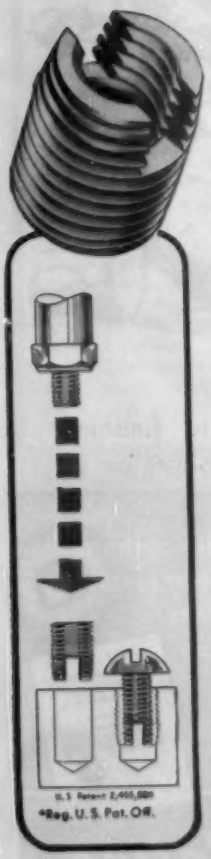
216-222 Thomas St. • Newark 5, N.J.
Telephone: Bigelow 3-8900-1-2-3-4
For more information circle No. 69 on the Reader Service Card

THREADED FASTENERS

need a firm grip, too!



TAP-LOK INSERTS* provide an exceptionally rigid foundation for tapped threads in light metals, plastics and many other of the newer structural materials. Because they are self-tapping and solid in construction they can be inserted without any "fuss and feathers". Assembly rejects are almost unknown.

TAP-LOK INSERTS are widely used as original equipment. Also, for salvage of stripped thread and similar repairs, their use is increasing rapidly.

Because it taps its own thread, the Tap-Lok Insert is always a perfect fit in the boss material. It is held firmly in place by a friction lock that gives it maximum torque-and-pull resistance. It is completely free from the time-wasting failures of cast and molded inserts.

TAP-LOK INSERTS are installed with a simple driving tool having a hardened threaded shoulder stud which engages the internal thread of the insert. When staking is desired, the driver shoulder performs this operation at the same time the insert is seated. Production line installations of the insert are readily made by means of a standard tapping attachment on a drill press.

U.S. Patent 2,460,001
*Reg. U.S. Pat. Off.

Send for descriptive folder

Also manufacturers of Groov-Pins for positive locking press fit.

GROOV-PIN CORPORATION

1122 Hendricks Causeway Ridgefield, New Jersey

For more information circle No. 71 on the Reader Service Card

ards, feature a double wedge grip which, the manufacturer claims, makes possible the assembly on rubber covered hose without skiving.

Through the use of special slotted bushings the manufacturer is said to have made possible the retightening of the couplings on the hose without disassembly when and if they come loose through vibration or flexing. No special tools or mandrels are required for assembling the couplings on the hose.

Joy Mfg. Co.
For more information, circle No. 203 on the Reader Service Card

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EMULSION CLEANER . . . freely water soluble

A new dust-free, water-soluble powder composition that exhibits high surface activity and great cleaning efficiency in the removal of protective mill oil from steel, has been announced.

The material is used as a tank immersion cleaner at 160F to 180F. The cycle employed is 0.5 to 3.0 minutes, depending upon the amount and tenacity of the soil present. The cleaner is said to be especially effective when using the Keykote process to deposit a molybdate coating prior to painting.

The cleaner is strongly buffered and accordingly exhibits a fairly constant pH over a wide range of concentration. The product has exceptional ability to suspend soil and in the recommended concentration shows good cleaning ability for intervals of one month or more.

Kelite Products, Inc.
For more information, circle No. 204 on the Reader Service Card

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VACUUM MELTING FURNACE . . . for moderate sized melts

A new vacuum melting and casting furnace suitable for moderate size production of high purity metals or for experimental and pilot scale work has been developed.

The new furnace, model 436, has a melting capacity of 50 lbs. of steel or other metals. The furnace which will melt and

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All grades of silica ideal for precision casting by the investment molding process

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Will meet the exacting requirements of most precision casting work

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Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

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Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

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50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

CONFORMING MATRIX CORPORATION
346 TOLEDO FACTORIES BLDG.
TOLEDO 2, OHIO

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cast completely under vacuum is equipped with a tilting crucible and a two foot turntable on which multiple molds can be supported for semi-continuous casting. It can also be fitted for casting by bottom pouring.

All operations such as charging, alloying, sampling, temperature measurements, tilting and rotation of the mold table can be done from outside the furnace without breaking the vacuum.

F. J. Stokes Machine Co.
For more information, circle No. 196 on the Reader Service Card

FLAT CASTINGS
continued from page 42

drilled, one of which is tapped.

The optical bench adapter requires even less work. The slotted holes are cast and only the two round holes need to be drilled.

Inserts In Tapped Holes

On most of the parts illustrated a plurality of tapped holes are required in the aluminum. When the parts were first designed the aluminum castings were tapped to receive steel or brass machine screws. The threads in the aluminum did not hold up satisfactorily under the service requirements. In almost all cases, therefore, Tap-Lok inserts are now used with complete success.

Finishing of the component parts is simple. The surface as cast is sufficiently good so that no grinding or sanding is necessary. Flash, parting lines, vestigal gates, etc. are removed and when final machining has been accomplished a gray wrinkle finish is sprayed on and the painted castings baked. Generally no undercoat or surface preparation is required.

These several examples show how the plaster mold casting process is pre-eminent as a production method when the number of parts to be made is relatively limited and where the dimensional accuracy is such that a sand casting will not suffice.

Prolong the life of your dies with PANGBORN HYDRO-FINISH®

Fine mesh abrasive suspended in water —that's how Pangborn Hydro-Finish precision cleans and finishes molds and dies. The result? Tolerances are held to .0001" and you get more years of service from your dies. In addition, Hydro-Finish eliminates further finishing operations by removing directional grinding lines . . . cleans off scale and discoloration in *minutes*.

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with the right equipment for every job

50th Anniversary Medallion

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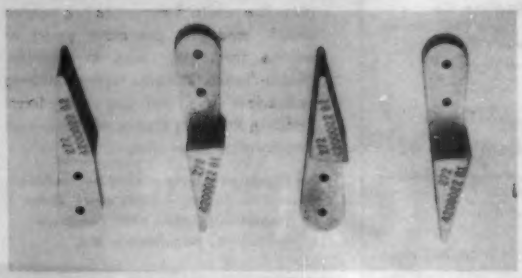
SIMPLIFIED SOLUTIONS FOR DESIGN PROBLEMS

INVESTMENT CASTINGS



IN making spacer blocks to support the skins at the leading edge of aircraft inboard flaps, The Glenn L. Martin Company formerly machined the part from 75S-T6 aluminum alloy bar stock.

Because of the cost involved, the company sought a different precision method to produce this part. The result: spacer blocks are now investment cast of 356-T6 aluminum alloy for the Martin Company by the National Precision Casting Corporation. The investment casting process has slashed the cost per part by approximately 50 percent. This is due chiefly to the elimination of the numerous machining operations. In addition, the investment cast part is so surface-smooth that no polishing is required.

DIE CASTINGS

IN order to generate a cam surface of the complexity shown on a piece of highly irregular shape, machining of a sand casting was much too expensive. The alternatives were a brass forging or a brass die casting.

Selection of a brass die casting made by the Doehler-Jarvis Div. of National Lead Co. was made because the piece, a paint sprayer cam, could be made more economically and with greater accuracy by this method than by forging. The cams are cast in a single cavity die at the rate of 139 pieces per hour using Doehler's No. 1 brass alloy. This production rate and the superior surface finish are accomplished in spite of the highly irregular parting line needed. No secondary machining operations of any consequence are needed on the piece.

SHELL MOLD CASTINGS

HIGH chromium alloy shell mold castings are being used in domestic garbage disposal units manufactured by at least two of the major companies in that field.

These rings, used for grinding waste material, are in regular production by Cooper Alloy Corporation. They represent the growing application of this type of casting for high volume, low cost components, where the number of castings is high enough to amortize tool costs.

The requirements for these shredder rings, a pair of which is illustrated, include moderately tight tolerances, thin wall sections and close specifications on surface finish and hardness.

Dimensions of these rings are approximately 6" in diameter and 1¾" in height. Tolerances are ±.010 across all diameters: ±.015 across the mold parting; and ±.005 on flatness.

The surface finish specified and met is 125 RMS or better, while hardness requirements, when annealed by the foundry, call for rehardening to 60-64 Rockwell C.

Alloy being used for the shredder rings includes: Carbon, 1.35 — 1.55; Chromium, 12.4 — 14; Silicon, .50 — .70; Molybdenum, .40 — .60; Manganese, .30 — .50; Vanadium, .80 — 1.20; Sulphur and Phosphorus, .02 max.

DIMENSIONAL CONTROL
continued from page 44

effect of this situation in their particular process. A fast setting wax and particularly strong investment will minimize the shrink far more than a wax that will continue to shrink for some time after removal from the die, combined with an investment with a low crush strength.

Having taken all special features into consideration and having applied the proper factors to the master, we can now be sure of a pattern that should produce a satisfactory casting. Since the shrinkage of castings is a capricious thing, some dimensions may vary from what was anticipated. These are usually minor variations readily corrected in the master pattern or injection die.

Unfortunately, a dimensionally correct master pattern or die does not necessarily insure acceptable castings. Inherent in the investment casting business are process variations that can affect the part to a considerable degree. We will follow the normal operational sequence and discuss individually the variations that can detrimentally affect dimensional control.

1. Wax Injection

(a) It is essential that the wax used be consistent in formulation, temperature and dwell time. Deviation in any of these three can cause variation from the anticipated shrink factor. Temperature, in particular, should be kept at a constant level for satisfactory results.

(b) Where injection machines that have a pneumatic clamping action are used, care must be exercised to insure that the injection pressure does not exceed the effective clamp pressure and cause an opening of the die. In the case of large area patterns, such as vanes, this may very well be the cause of airfoil sections running thicker than is allowable.

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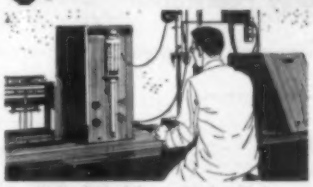
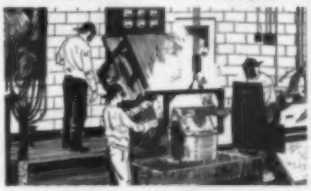

Heats checked for chemical analysis.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Exactly predictable metallurgical control of finished casting is assured by MasterMet control of high-temp alloys, tool, stainless, and carbon steels

You specify the alloy — we'll tailor it to your needs, backed by a *certified* analysis! Name the quantity and the fast delivery will surprise you! Preparation can begin almost immediately after receipt of order. MasterMet "alloy tailoring" gives you all this:

MATCHED ALLOYS TO YOUR MELTING PROGRAM — Close control assures a constantly uniform melt. The results you get from a sample cast are the same as the final production run.

MASTERMET CERTIFIED ANALYSIS—Regularly furnished are notarized certificates insuring alloys that will cast to your exact production specifications.

PRODUCTION MELTS OR SAMPLE JOBS — A combination of test furnaces and larger multiple production furnaces assure completely flexible service at any time.

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METALLURGICAL SPECIALISTS

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happen, a dial indicator pickup between the top platen and the table of the machine will immediately show any tendency of the die to open. Even where hydraulic clamping is used, air in the hydraulic fluid can allow a cushioning of the clamp if the injection pressure is too high.

In addition, every effort should be made to avoid use of worn dies, which form a large parting line or flash is formed during injection. Removal of this flash or parting line can again cause dimensional deviations unless very carefully performed. Injection dies should be constantly checked for nicks or blemishes that may occur in critical areas, since this type of deviation is repetitive. If these blemishes should escape visual inspection, as can happen with a dark wax, their subsequent removal can result in many rejects.

(c) It has been found that temperature control, where wax patterns are made or stored, is very desirable. While temperature variations do not cause any great change dimensionally, they could affect patterns that were of a borderline nature insofar as tolerance is concerned. More important is the fact that temperature control tends to minimize distortion in the patterns. Where castings have to be submitted to subsequent gauging operations, removal of these inherited warpages can present a difficult problem.

2. Wax Assembly

An important feature of wax assembly is the positioning of auxiliary gating in relation to critical dimensional areas. Removel of such gates by grinding can cause an excessive removal of adjacent material. In line with this, we found the use of assembly fixtures very helpful in correctly locating such gates. In addition, fixture assembly will prevent bending and distortion of the patterns that again can cause a problem in subsequent gauging.

3. Investing

It has been found that deviations from normal processing at this operation can cause astonishing variations in dimensional measurements. For example, premature gelation of the binding agent causes a mold of very low density, with the result that castings can actually grow in chordal and thickness dimensions .010 to .012 of an inch, because of excessive expansion of the investment.

By the same token, mold cracks can also affect dimensions to a considerable degree. Cracks radiating from the leading and trailing edges of vanes and blades cause a growth in the leading and trailing edge radii and in the maximum airfoil thickness. Similarly, cracks that emanate from the concave or convex side of the airfoil section can cause an increase in the chordal dimension.

Where such cracking does occur, it can generally be laid to one of four causes: (1) flask size too small, creating a thin wall of investment between the flask and cluster; (2) green strength of the investment itself

Continued on page 83

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SELLERS OF HOEGANAES SPONGE IRON POWDER

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FULL VS SEMI-PERMANENT
continued from page 36

form of local recesses on the cast surface accompanied by burnt areas. When this occurs, artificial means may then have to be employed to withdraw the core gases.

When castings contain heavy sections which cannot be fed directly by risers, shrinkage in these areas is usually overcome by resorting to the use of chills in the sand cores. Extreme care must be exercised in selecting the type and size of the chill for each situation. If the chilling of the molten aluminum is accomplished too quickly, blows and shrinkage will result.

The chills must be properly located in the core box and the seam between the sand and the chill must be doctored to prevent metal flash in the casting operation adhering the chill to the casting when the sand core is knocked out. Sound foundry experience will usually determine the type of chill to be used and the method of doctoring the area where the sand meets the metal chill.

Gating of a semi permanent mold casting usually requires the same considerations that apply to gating a full permanent mold casting. Successful gating should always be designed to avoid carrying the molten metal over the core prints

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...High Costs Got You Cornered?

Then see how Paramount die castings contribute lower costs and higher strength in these corner joints for combination aluminum storm doors.

A leading manufacturer of storm doors wanted a dependable way to assemble the mitred corners of extruded door frames. The reinforced I-beam section of these Paramount-produced die castings solved his problem. The die cast corners give strength, rigidity, ease of assembly and lowered costs.

You, too, can call on Paramount to help solve those problems that now have you cornered.

Paramount offers: 1) the services of a completely modern die casting plant; 2) your choice of zinc, aluminum or magnesium alloy; 3) the benefits of our many years experience producing die castings for all types of products.

If you want to get a glimpse of our facilities, and some of the castings Paramount is producing, send for this free brochure. It's yours for the asking.

ALUMINUM, ZINC AND MAGNESIUM DIE CASTINGS

PARAMOUNT
Die Casting Company
St. Joseph 1, Michigan

For more information circle No. 51 on the Reader Service Card

The LITEMETAL BULLETIN

PLATING ALUMINUM DIE CASTINGS REQUIRES SPECIAL TECHNIQUES

Close Co-Operation Between The Die Caster And Plater Is Essential To Successfully Give Aluminum Die Castings Fine, Smooth Finishes

Commercial plating of the light metals is relatively new. As in the zinc die casting industry, aluminum die casters have had to virtually re-learn their art in order to produce castings of sufficiently high quality to provide flawless plated surfaces.

Litemetal has proved itself capable of producing plating quality castings, for the Kitchen-Quip Saladmaster (illustrated), in large quantities. Working closely with one of the most successful platers of aluminum, Litemetal has developed the high quality standards and specialized techniques necessary to make plating of this die cast product practical.

Because of its lightness and lower cost, die cast aluminum was chosen for the body, handle and legs of the Saladmaster. Virtual elimination of machining and consequent labor savings effected, plus reduced shipping costs, made this choice most practical. The product's required appearance was attained with chromium plate. Production rates now approach 1,000 sets per day and will increase greatly as soon as plating facilities can be expanded.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST Inc.

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PLANT AND EXECUTIVE OFFICES

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and to avoid, wherever possible, letting the molten metal wash against the sand core.

If the sand core is too soft, the molten metal will wash off sand particles which will flow into the metal and solidify in the casting. Invariably, these sand particles appear on surfaces of the casting that are to be machined, resulting in hard spots that will cause the casting to be rejected. Risers on semi permanent mold castings should be heavier than on permanent mold castings since less chilling action occurs with sand cores.

The tolerances on semi permanent mold castings must be greater than the tolerances held on full permanent mold castings. This is due to the fact that the sand cores will vary to some degree on each casting and cannot maintain the close uniform dimensions obtained from metal cores in a full permanent mold.

This variation also contributes to the shifting of the sand cores in the mold. To insure against this condition, a greater amount of finishing stock should be allowed on machined surfaces.

Normal tolerances on dimensions formed by sand cores should be 1/32" with 1/16" as a minimum allowance for machining stock. As the size and complexity of the casting increases the tolerances and finishing stock allowances may materially increase.

The surfaces formed by sand cores are usually much rougher than the surfaces formed by the metal mold sections. A standard of about 500

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micro inches is average. Efforts can be made to reduce this surface roughness to 300 micro inches by spraying the cores with special materials which fill in the pores of the sand cores. This practice is only adhered to when customer surface specifications on the sand cored areas are clearly established on the blueprint for this closer control.

Minimum wall thicknesses must be increased in a semi permanent mold as opposed to full permanent mold operation to take care of core variations and core shifts. A wall thickness of 5/32" should be the general practice in producing semi permanent mold castings although a ⅛" wall can be obtained under controlled conditions.

The physical properties of castings made by either the semi permanent mold process or the full permanent mold process are usually the same. It is possible that sections of semi permanent mold castings formed by the sand cores may show some decrease in tensile strength due to the absence of the rapid chilling effect obtained from sections formed by the metal mold.

The molten aluminum solidifies faster as it comes in contact with the metal mold sections producing a smaller grain size than the grain size usually found in sand castings. This reduction in grain size, producing a dense, homogeneous structure (throughout the casting) permits permanent mold castings to provide higher tensile strengths than can be obtained, in the same alloys, from sand castings. The slower solidification at the sand cored areas may result in a modest increase in grain size with a related drop in tensile strength.

All the aluminum alloys which are cast by the full permanent mold process are satisfactory for the semi permanent mold process. It is possible that alloys such as 220 and almag 35, which are high in magnesium content, might even give improved casting conditions in the semi permanent mold process, with all factors considered, since the hot shortness or shrinkage of these alloys may be minimized to some extent by the use of sand cores which allow these alloys to contract. Heat treating of semi permanent mold castings is identical in operations and results with full permanent mold castings.

Due to the use of the sand cores, the cost of semi permanent mold castings is usually higher than those made by the full permanent mold process. The labor costs involved in making the sand cores, the slower molding cycle and the higher scrap losses due to the conditions that have been outlined above contribute to this ratio in cost.

Tooling costs, as a rule, should be lower on semi permanent molds unless offset by the cost of intricate and expensive core boxes and dryers. If a limited quantity of castings is required, wooden core boxes can be used to aid in reducing equipment cost. For large production runs, however, metal equipment must be used in core production.

Semi permanent mold castings can answer many intricate design problems when the method of fabrication is being considered.

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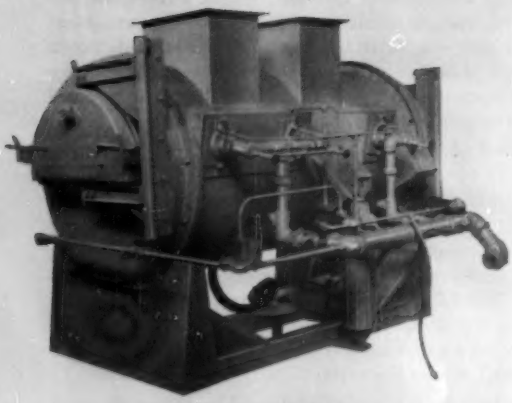

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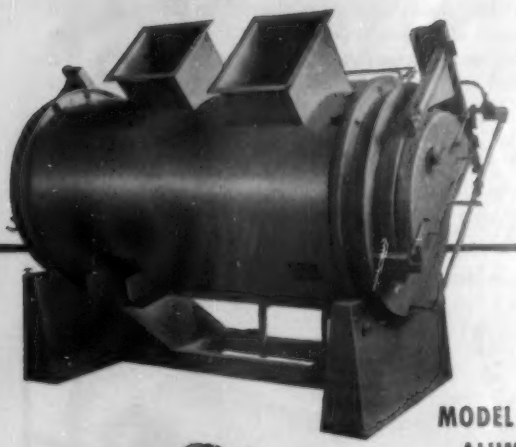

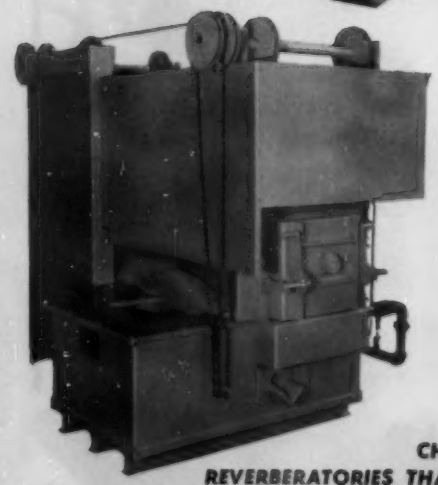

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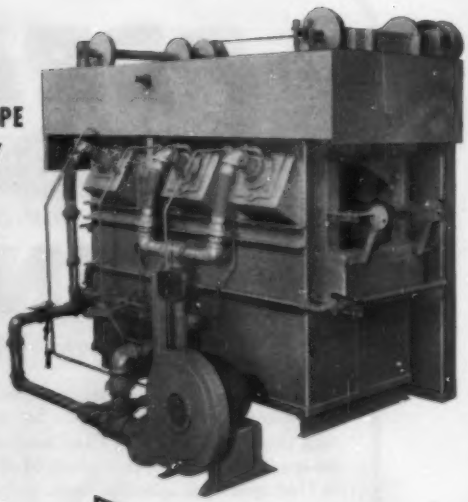

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Fire Resistant Hydraulic Fluids For Die Casting - Part 2, Non-Aqueous-Base

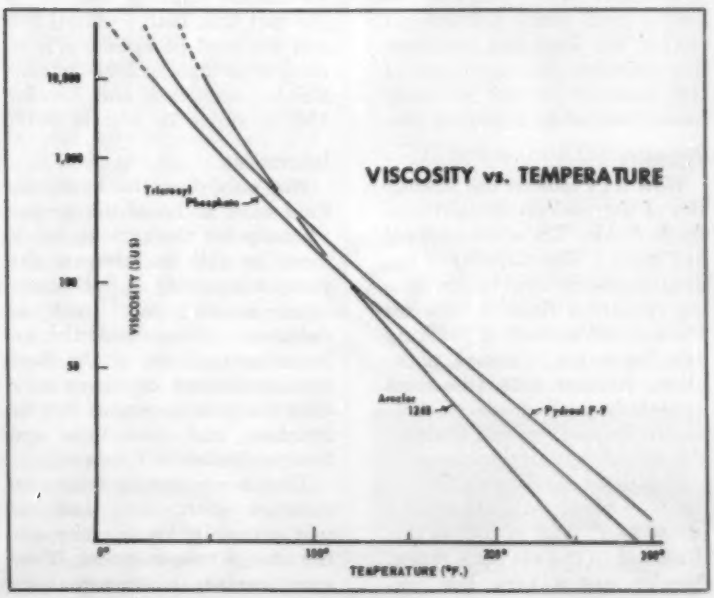
By JOHN S. HARRIS
Functional Fluids,
Monsanto Chemical Co.

THERE are two general ways of achieving fire-resistance in a fluid. The first way is to take a fluid which might otherwise be flammable and add to it some material which makes it less so. In the case of the aqueous-base fluids, it is water that is added to reduce the flammability.

The other method of achieving a fire-resistant fluid is to find a fluid that inherently resists burning. This latter method may sound quite easy, but there are problems. First, there aren't very many classes of chemicals that resist fire to an adequate degree. And second, a hydraulic fluid needs to be not only fire-resistant, but it also must have excellent lubrication characteristics, lack corrosive action, have high stability, must possess the proper viscosity, and have quite a number of other characteristics.

So far there are three commercial products that fit into this second class, the straight synthetics. These are Aroclor** chlorinated biphenyl and Pydraul** F-9 fluid, which are exclusive products of Monsanto, and tricresyl phosphate, which is available from several suppliers.

1. The relationship between viscosity and temperature for three different synthetic fire-resistant hydraulic fluids is charted below.



Tricresyl phosphate is sold by the Celanese Corporation as Lindol HF**. Tricresyl phosphate and Aroclor represent two products which were originally developed for quite different uses, that were found to have adequate fire-resistance and the other necessary characteristics to lend themselves as hydraulic fluids. Pydraul F-9 was the result of a deliberate effort to try to improve certain shortcomings in existant hydraulic fluids.

Tricresyl phosphate first achieved commercial importance shortly after the first World War as a plasticizer for cellulose nitrate when the Japanese cut off the camphor supply. Since then it has found its way into many other uses, the most recent of which is as a gasoline additive — the advertising of which you probably have noticed.

Aroclor is produced in a number of grades and has been used for close to 20 years as a fire-resistant heat-exchanger fluid, transformer oil, plasticizer, and in many other applications. Although it was used for die casting as long ago as 15 years, it hasn't been until the last six or eight years that emphasis has been given to it in this application.

Pydraul F-9 is the most recent of the three, and, as mentioned, was designed specifically for hydraulic applications.

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Continued on next page

CHARACTERISTICS AND PERFORMANCE DATA...

TABLE 1

Timken E.P. Test

Fluid	OK Load (lbs.)	Film Strength (psi)
Tricresyl Phosphate	35	17,000
Aroclor 1248	25	11,200
Pydraul F-9	50	17,500
Typical Petroleum Oil	less than 5	seized

TABLE 2

Shell 4-Ball Wear Test

	Scar Diameters (mm.)			
	Steel on Steel		Steel on Bronze	
Fluid	1 kg. load	40 kg. load	1 kg. load	40 kg. load
Tricresyl Phosphate	0.14	0.52	0.46	1.03
Aroclor 1248	0.38	0.73	0.45	0.81
Pydraul F-9	0.16	0.70	0.30	1.08
Typical Petroleum Oil	0.20	0.80	0.96	2.71

TABLE 3

Almen Wear Test

Fluid	Wear (mg. metal lost)
Tricresyl Phosphate	1.5
Aroclor 1248	39.0
Pydraul F-9	2.0
Typical Petroleum Oil	Seized in 1 minute

TABLE 4

Corrosion and Oxidation Test
(Govt. Spec. AN-VV-O-366b)

	Initial	Pydraul F-9 Final	Allowable
Viscosity at 130°F.	23.6 cs.	24.1 cs. (+2.1%)	−5% to +20%
Neutralization No.	0.05	0.07	+ 0.20
Fluid Evaporation		3.0%	8.0%
Fluid Separation		None	None
Effect on Metals:			
Copper		−.16 mg./cm²	± 0.6 mg./cm²
Iron		+ .01	± 0.2
Aluminum		+ .02	± 0.2
Magnesium		+ .02	± 0.2

TABLE 5

Hydrolytic Stability (MIL-F-7100)

		Pydraul F-9	
Viscosity (Cs. @ 130°F.)	Initial	Final	Allowable
Acidity (NN):	20.91	20.13 (−3.7%)	−5% to +15%
Fluid Layer			
Water Layer	0.08	0.08	
Effect on Copper (mg./cm./²)	——	0.03	0.63 total
Sludge (gms.)		−0.05	± 0.5
		0.002	0.375

Fire Resistant Fluid—Cont.

Perhaps the easiest way to quickly cover these three fluids is to take up the requirements of a hydraulic fluid and to see how well each of the fluids meet these. According to the composite opinion of a number of hydraulic experts, the most important characteristics of a hydraulic fluid are:

Fire resistance
Viscosity
Lubrication
Non-corrosiveness
Stability
Resistance to moisture
Compressibility
Compatibility
Toxicity and Odor
Service life and Price

As you can see, there are a lot of things to worry about if anyone is so rash as to try to design a synthetic hydraulic fluid.

Fire-Resistance

I have put fire-resistance at the top of the list on the table because this is what we are discussing here. Dr. Millett* has covered well what we mean by "fire-resistance" and the fact that none of these fluids is non-flammable under all conditions. I can add little to this.

*Note: See Precision Metal Molding, Dec. 1954, pg. 85.

By way of verification of the safety of these fluids, I *can* add that to our knowledge certain of these fluids have been involved in line breaks and spills. They have been dumped on molten metal, on red hot ingots, over motors and flames, and sprayed into furnaces. In no case has there been propagation of the flame.

We have already accumulated quite a file of testimonials from our customers who have had line breaks—at least those who admit having had them—and a good many pointed out that if the fluid had not been fire-resistant the conditions of the accident would probably have resulted in a serious fire.

Viscosity

Now let's look at the viscosities of the various straight synthetic fluids. These are charted in Figure 1. The majority of hydraulic pumps used in die casting require a fluid of between 150 and 300 seconds at 100F. As can be seen, tricresyl phosphate, Aroclor 1248 (the most commonly used grade of Aroclor in die casting) and Pydraul F-9 all fall within this range.

The three fluids do differ in the way they vary above and below 100F., and of course this is related to the viscosity index. Aroclor has a very low viscosity index and thus thickens more rapidly at low temperatures and thins out more rapidly at higher temperatures. Tricresyl phosphate has a viscosity index of around -40, and, as can be seen, this is somewhat better than Aroclor 1248. Pydraul F-9's viscosity index is around +30, and thus the change of viscosity with temperature is least of all.

One point that I would like to call to your attention on this chart, as it will come up when we discuss stability later on, is the fact that both Pydraul F-9 and tricresyl phosphate can be used to as high as 300F. in continuous operation, and Aroclor 1248 is stable to around 600F.

Lubrication

Not only does the hydraulic fluid have to be of the proper viscosity for the system, but it must be able to lubricate the pump adequately as well as any other moving parts such as valves or cylinders. If the lubricating qualities of the fluid are insufficient or marginal, then pump replacement will be frequent and down-time and lost production will be costly.

There are many ways to measure lubrication, and, as you probably know, they are not always too consistent. However, certain laboratory tests

are widely used and can be correlated with what is found in actual use.

There are two major characteristics that a lubricant should possess. It should have adequate film strength and hold to the metal surfaces tightly enough to stay between them under load, and it should protect the surfaces from wear. The two properties are quite different and are measured in different ways.

One of the most commonly used tests to determine the film strength and extreme pressure characteristics of lubricants is that developed by the Timken Roller Bearing Company which is called the Timken Extreme Pressure Test.

Table 1 shows the results obtained with the synthetic fluids as compared to a typical petroleum fluid. Note that the film strength of the synthetics are much higher. In fact the petroleum fluid, which was a premium grade, seized at less than 5 pounds, the lowest test weight used.

To measure the other characteristics of a lubricant — anti-wear — any of several tests can be employed. We use the Shell 4-Ball and the Almen principally.

In the Shell 4-Ball test, there are three metal balls which are fixed in place. The fourth ball is placed on top and is revolved by the cup above it which is turned by a shaft. The load is applied from below. The amount of wear is measured by the size of the scars on the three bottom balls.

In the test reported in Table 2, the procedure was to test a steel ball against three steel balls and a steel ball against bronze balls. These are, of course, the two most commonly found materials in bearings. The test was run for one hour at 600 rpm and at a temperature of approximately 170F. Two test loads were used, 1 kilogram and 40 kilogram (which are about 2 pounds and 90 pounds respectively).

The diameter of the scars on the lower balls are shown in millimeters and are a measure of the wear with the fluid. It can be seen that all of the straight synthetics show up very well, and even at the very high load are somewhat better than the petroleum oil. Some lubricants will allow the balls to weld to each other at much lower loads.

Another test which we use to measure the amount of wear with different lubricants is the Almen Wear Test. This consists of a split bushing which is clamped to a shaft of a larger diameter under a certain pressure. The shaft is revolved at a constant speed, and the bushing is then weighed to determine the loss of metal due to wear.

Table 3 shows the results of this test. The load was 4000 psi and the shaft speed 600 rpm. The wear is reported in milligrams of metal lost during the 20 minute run.

All of the straight synthetics were better than the premium hydraulic fluid in this test. By way of comparison, an SAE 10 crankcase oil gives a wear of about 2 mg. Since the load was only 4000 psi, which is well below the film strength of the straight synthetics, good wear characteristics could be expected at considerably higher loadings. This would not be true with a fluid possessing relatively low film strength, as the film of lubricant would fail and scoring and seizure would occur.

Non-Corrosiveness

There are a number of metals of construction in the average die casting machine, and the hydraulic fluid should not attack these either initially or after use, nor should it promote corrosion from the air or from moisture. Tricresyl phosphate, Aroclor and Pydraul F-9 all act quite like petroleum fluids in this respect. None of them attack metals and, in fact, seem to exert protection to bare metal surfaces.

Stability

Since the fire-resistant fluids are designed to be resistant to heat, it is not surprising that they have exceptional stability.

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As mentioned earlier, tricresyl phosphate and Pydraul F-9 can be used continuously as high as 300F, if necessary. Aroclor has been used industrially as high as 600F. There isn't a hydraulic system on the ground or in the air at the present time that could use a fluid at this high a temperature, but these figures indicate the tremendous safety factor in the stability to heat.

And this same fire-resistance is an indication of extreme resistance to oxidation as well, since burning is, of course, simply rapid oxidation. In the matter of stability, the three straight synthetics are far beyond even petroleum fluids.

Table 4 shows the results of the corrosion and oxidation stability test which is used by the Government for petroleum hydraulic fluids.

In this test, strips of copper, iron, magnesium and aluminum which are all immersed together in the fluid. This is heated to 210F. and held there for 168 hours. The fluid and metal strips are then examined. As you can see in Table 4, this type of fluid has excellent stability. The results shown here are probably fairly close to what can be expected from the other two straight synthetics.

Finally, the fluids must be stable to temperature change without precipitation of additives. Since numerous additives are not required in the straight synthetics, this is no problem. Separation does not occur in use.

Resistance to Moisture

In most hydraulic systems, and particularly in die casting machines, there is always a possibility of contamination with water. This can come from the air, from the die cooling water, or from the oil cooler if one is used. Thus, the hydraulic fluid should not be affected by water, and preferably it should be susceptible to separation from it.

Neither tricresyl phosphate, Aroclor or Pydraul F-9 will hydrolyze in the presence of water under the temperature conditions in hydraulic systems. Analyses have been made on certain of these fluids that have been operated for a year or more with considerable quantities of water in the reservoir, and the acid number has still been quite low. Government specified tests for hydrolytic stability verify this as well.

Table 5 shows the results of the hydrolytic stability test specified in MIL-F-7100. Again the only fluid for which we have these results is Pydraul F-9, but the other straight synthetics would likely give similar data.

This test consists of placing a mixture of the fluid and water in a beverage bottle along with a strip of pure copper which is usually an excellent promoter of hydrolysis. The bottle is capped and then rotated end over end for 48 hours at 200F. The liquids are then checked. Again the results show the very high stability of the straight synthetics as the actual changes are far less than would be allowed under the specification.

As far as the ability to separate the fluid and the water is concerned, none of the straight synthetics is soluble or miscible with water. All form two layers with the water on top and the fluid on the bottom. Thus the water can be removed easily. Incidentally, this makes possible the reclaiming of spilled or contaminated fluid and this will be discussed at little later.

Compressibility

In some hydraulic applications compressibility is of great importance. For example, in machine tools or in control systems the fluid should be as rigid as possible. This is less important in die casting, but still the less compressible the fluid, the better the response and efficiency of the system will be.

Of the three synthetic fluids, we have compressibility data only on Pydraul F-9, and Aroclor, but we would expect that the value for tricresyl phosphate would be of the same order of magnitude.

In Table 6 these values are shown as bulk moduli. The

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bulk modulus is the reciprocal of the compressibility, and the higher the number the less compressible the fluid.

As can be seen, the synthetic fluids are appreciably less compressible than is petroleum oil.

Compatibility With Other Components

In addition to the pump, piping and metal parts in a hydraulic system, there are a few other rather essential components such as packings and seals, filter, paint, hose, and so on.

In the early stages, the choice of packings was the greatest single problem that faced the straight synthetic fluids. All three cause swelling of neoprene, probably the most commonly used packing material. This did not present a problem in static packings, since usually a tighter seal resulted, although it was necessary to replace the packing if it was removed. But in dynamic or moving seals the swelling is not desirable.

Investigations have now shown that a number of packing materials can be used with the synthetic fluids without excessive swelling. These include butyl rubber, Teflon, Kel-F, nylon, leather, silicone, polyethylene, and vegetable and mineral fibers.

TABLE 6
Bulk Modulus

Aroclor 1248	428,000 psi
Pydraul F-9	387,000 psi
Distilled water	337,000 psi
Typical petroleum fluid	280,000 psi

Over 20 manufacturers have told us that they offer satisfactory packings for Pydraul F-9. All configurations of packings from O-rings to oil seals are available.

Since many have inquired about the availability of such packings we have printed up a list of those manufacturers who have told us they do have them, and copies are available. Although the table was prepared specifically for Pydraul F-9, it is probably at least partially applicable to the other two synthetics.

A similar situation with regard to paint, several types of which were stripped by the synthetics, has been resolved by several paint manufacturers who now offer resistant finishes.

Though as mentioned, neoprene packings do swell in these fluids, this apparently has not been a problem with hose. By far the greatest volume of these fluids is being used in machines which have neoprene hose. However, we do feel that it is desirable to use a butyl-lined hose when replacement is necessary.

If filters are employed in a system, it is likely that the same filter which has been used with a petroleum fluid can be used with tricresyl phosphate, Aroclor or Pydraul F-9. By and large these act like oil, and if excessive quantities of water are not present, even the earth-type filters can be used.

Toxicity and Odor

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of low toxicity and present no industrial hazards. The straight synthetic fluids have been manufactured now for up to 35 years. A great deal of data is available on all three and they have been evaluated extensively from a toxicological point of view.

In the vapor state, after exposure to hot surfaces, tricresyl phosphate and Pydraul F-9 have gross, acute toxicities comparable to that of petroleum oil under the same conditions. Aroclor, when used at higher temperatures, as in heat exchangers, should be provided with adequate ventilation if it is an open system. When used in the normal closed hydraulic system, no special precautions are necessary.

All of the fluids have distinctive though not objectionable odors when heated. Because the odors are somewhat different than that of petroleum fluids, they serve a useful purpose in calling attention to the fact that a leak has occurred in a hot area.

Service Life and Price

The last major consideration in a hydraulic fluid, though certainly not the least, is service life and price. It may seem strange to lump these two together, yet if the hydraulic fluid can be given twice as long a life, its real cost is only half as much.

The price of the fluids vary somewhat in the quantity bracket and the delivery point, but roughly, at the present time tricresyl phosphate sells for $3.50 per gallon delivered, Pydraul F-9 for $3.35 per gallon, f.o.b. St. Louis, Missouri, and Aroclor 1248 for $2.25 per gallon, f.o.b. St. Louis.

Obviously all of these are at least several times the cost of petroleum oil. Forgetting safety for the moment, is there any other way these high costs can be justified?

First of all, how long can the straight synthetic fluids be used? The high stability of

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are lost from the system or contaminated. This is now being done quite successfully. Even catching the drip from small leaks until they can be repaired has resulted in savings of 10 percent of the fluid or more. In other plants, where drip pans under the machines are employed, over 40 percent of the fluid purchased has been reclaimed and re-used.

Reclaiming is extremely simple since the water separates of its own accord, and only filtration is then required. Detailed information on this process is available if it is of general interest.*

In summary, the synthetic fire-resistant hydraulic fluids are not only safer fluids, but they are also excellent hydraulic fluids in their own right. They differ somewhat in their characteristics, and which of the three might be most satisfactory for any given installation will depend to a great extent on the installation itself and the qualities which are desired.

By adequate maintenance and reclaiming where convenient, it is possible to use fire-resistant fluids at an expense no greater than that you presently have for flammable fluids, and it can even be less.

Finally, the author wishes to express his appreciation for the technical assistance received, particularly to Mr. Douglas H. Moreton of the Douglas Aircraft Corp., and to Dr. Roger E. Hatton, of the Monsanto Chemical Co.

***Editor's Note: Part 4 of this series on fire resistant hydraulic fluids will be devoted to reclamation techniques.**

BENDIX CHANGES DIVISION NAME

Change of name from Eclipse-Pioneer Foundries division to Bendix Foundries has been announced by the Bendix Aviation Corporation.

The change was made to emphasize the division's policy of serving the needs of a wide range of industrial customers in the aviation, electronic, and marine fields, according to Raymond P. Lansing, Bendix vice president and group executive.

The division, one of the largest operations of its kind in the country, supplies precision aluminum and magnesium castings, using sand, die, plaster, shell-mold, and permanent-mold processes.

ADM. ALAN G. KIRK ELECTED MERCAST HEAD

Admiral Alan G. Kirk, chairman of the board of the Mercast Corporation, New York, has been elected president of the corporation by a meeting of the board of directors. He succeeds S. J. Sindeband who was recently appointed president of The Teleregister Company.

Admiral Kirk served as Ambassador to Russia during the period 1949-1952. In World II, he commanded the Normandy Invasion, June 6, 1944. He has been Chairman of the Board of Mercast for the past year.

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25 per cent less machining is required on nine different size adjusting rings for relief valves when they are precision cast by Inco. They are produced in 316 stainless steel for Crosby Steam Gage & Valve Company. For unusually severe service, Inco can precision cast the rings in alloys such as "S"® Monel — without new patterns or dies!

Look where Inco Precision Castings cut machining time 25%

See the gear-like teeth in these adjusting rings? They're nasty things to machine. The largest ring is only three inches in diameter. Others range down to one inch.

Formerly, when sand cast, the teeth needed a great deal of machining. Production was slow. Costs ran high.

Then Crosby Steam Gage & Valve Company decided to try Inco precision investment casting for the rings which go in their relief valves. Now machining time is cut 25 per cent.

Inco precision casting has eliminated two facing operations, greatly reduced machining of the teeth and eliminated drilling and hand cleaning. Very little of the precision casting needs to be machined away as scrap. The over-all surface is smoother than with sand casting, too.

If *you* want to know more about the kind of production problems that have been solved with INCO precision casting, write for the new 16-page casting booklet, "Cast to Outlast."

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NEWS OF INDUSTRY AND ASSOCIATIONS

METALS DISINTEGRATING APPOINTS D. C. BRADLEY

The appointment of D. Cameron Bradley as assistant to the president has been announced by H. E. Hall, president of Metals Disintegrating Company, Inc., Elizabeth, N. J., manufacturers of metal pow-

D. C. Bradley

ders, metal pigments, metal abrasives, pulverizers and dust collecting equipment.

Mr. Bradley attended Lehigh University. He was associated with Bethlehem Steel Company at Saucon Open Hearth. Following that for five years, Mr. Bradley was with the Metallurgy Department of American Brake Shoe Co., as assistant staff metallurgist and then as plant metallurgist. Subsequently, he was staff engineer with W. G. Reichert Engineering Co. From 1947 until now, he has been with the New Jersey Zinc Sales Co.

REED-PRENTICE OFFICERS AND DIRECTORS ELECTED

New officers and directors of Package Machinery Company's newly acquired subsidiary, the Reed-Prentice Corp. of Worcester, Mass., have been elected. Package Machinery Co. recently purchased Reed-Prentice in a $4,000,000 transaction.

As announced by Roe S. Clark, president of Package Machinery Co., the new officers and directors of Reed-Prentice are: Roe S. Clark, chairman of the board; Roger L. Putnam, president; Frederick W. McIntyre, Jr., vice president in charge of sales; and Jackson R. Holden, secretary and clerk. Continuing in their respective positions are Donald H. Dalbeck, vice president and treasurer, Iver G. Freeman, vice president and Douglas L. Brennen, assistant treasurer.

In addition to Mr. Clark, Mr. Putnam, Mr. McIntyre, Mr. Dalbeck, Mr. Holden and Mr. Freeman, the new board of directors includes Tom Miller, Harold Mosedale, Jr., and Charles E. Palmer. The last three members are vice presidents and directors of Package Machinery.

NORTHWEST GETS SHELL MOLDING PLANT

Precision Castparts Corp., first investment casting firm in the Northwest, has announced the addition of complete shell molding facilities in its Portland, Oregon plant.

Although parts may be cast from shell moldings in almost any metal, the Portland firm is specializing in alloy and stainless steel production.

The Portland plant has complete facilities for producing castings by either the shell molding or investment casting processes from ferrous, nonferrous and alloy materials.

PURCHASE CONTROL OF ALUMINUM INDUSTRIES

Control of Aluminum Industries, Inc., of Cincinnati, producers of aluminum permanent mold castings, has been purchased for approximately $2,000,000 by Walter E. Schott and Harrison O. Ash.

Mr. Ash has been named president and general manager. Purchase was made in the name of Champion Industries, Inc.

T. S. RODERICK ELECTED ALCALOY VICE PRESIDENT

The election of T. S. Roderick as vice president in charge of sales of Alcaloy, Inc., associated with Dickey Industries, has recently been announced by James W. Dickey, president of Alcaloy, Inc., Cleveland, Ohio.

Upon receiving his discharge from the Navy in 1949, Roderick resumed his civilian career with Barnes Permanent Mold, Inc., where he served for five years as general manager.

Alcaloy, Inc. is a prime manufacturer of Navy bronze chain, attachments and accessories. The company also manufactures commercial components for many industrial firms, and a complete line of bronze safety tools. It is the largest non-captive bronze and brass permanent mold foundry in the United States. Its manufacturing plant is located in Trenton, N. J.

DR. R. H. PATCH DIES; WAS HOUGHTON EXECUTIVE

Dr. Richard H. Patch, vice-president—Operations, of E. F. Houghton & Co., died in Hot Springs, Ark., on November 13th. He had been with Houghton since 1926. He held an A.B. and doctorate from Harvard University. From 1914 to 1926 he was a plant official at the Midvale Co., Philadelphia.

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Abrasive Matter—Cont.

of the sample—85 to 65 percent for shot and 80 to 20 percent for grits.

Abrasive size is usually referred to by the aperture size of the nominal screen. The aperture is the distance between consecutive screen wires. Screen numbers have been assigned arbitrarily to aperture sizes to simplify the nomenclature. The screen number is used in specifying grits. For instance, G-18 means grits of nominal screen size number 18 or, referring to Table 2, an aperture of 0.0394 in. Similarly, S-330 means shot whose sample has a nominal screen aperture of 0.0331 in.

HEATH STEELE RETIRES AS AMERICAN METAL V.P.

Heath Steele, vice president of the American Metal Co., Ltd., has retired as a director and as vice president of the company after 37 years of service, having reached the mandatory retirement age. He will become a consultant to the company.

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Dimensional Control—cont.

too weak; (3) wax patterns mounted too close together in the cluster; (4) excessive wax expansion during dewaxing.

4. Casting

Very little information is available that shows the effect of preheat and casting temperature variations on the dimensions of a casting. Because of this, our company has embarked on a series of tests to determine thermal expansion characteristics of investment through various temperature ranges. These tests are being run with a dilatometer, but have not progressed to the point where any definite information can be published.

5. Cleaning

Sand or shot blasting represents a hazard only where extremely thin sections, such as trailing edge radii, are involved. In such sections, high blast pressure can cause either a rolling or erosion that can reflect itself in altered dimensions.

While not a dimensional problem, it should be pointed out here that absolutely clean sand is required in the final sandblasting operations. Presence of grog particles in the sand will mar the finish of the casting and, if surface finish requirements are rigid, may cause rejections at the final visual inspection.

6. Finishing and Polishing

Operations of this type always present a problem in dimensional control. Primarily, difficulty in this operation will evolve from poor quality workmanship where critical dimensions are overworked or mutilated.

A common problem is the use of too coarse an abrasive and the resultant removal of an excessive amount of material. Also within this series of operations falls the removal of parting lines. Since most companies perform this as a manual operation, an inexperienced or inefficient operator poses a great hazard to dimensional control. Since, in many cases, the parting lines are located in radii or thin sections, it is essential that extremely fine abrasive be used in removing the parting lines.

Removal of pits or surface indications that are outside visual inspection specifications for a given part can again cause stock removal that can greatly alter dimensions. Here it must be the responsibility of the inspection or engineering departments to determine whether such surface deviations can be corrected and still maintain the part within blueprint tolerances.

There is no question that surface quality and dimensional control go hand in hand. A high rejection rate at rough inspection, for surface imperfections, will inevitably lead to a correspondingly high dimensional rate of rejection, since

Continued on next page

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Dimensional Control—Cont.

those castings that are accepted are generally of poor quality and require considerable working to bring them within surface specifications.

Conclusion

The factors that have been set forth are those that have the greatest bearing on dimensional control. Other factors may exist that, in extreme cases, might cause dimensional deviations, but these would be so rare as to be practically negligible.

The matter of dimensional control represents an industry-wide problem that can be solved only by eternal vigilance and the highest possible standards of workmanship. As each company goes in its level of control, so goes the entire industry, because the poor quality standards of one company stand as an indictment of the investment casting process itself.

In closing, I would like to point out that it is extremely important that the investment casting industry decide upon tolerance ranges that are compatible with normal production processes. If these ranges are based on practical experience, the problem of dimensional control will be simplified.

Editor's Note: This article is based on a paper delivered before the annual meeting of the Investment Castings Institute.

OPPORTUNITIES

SALES REPRESENTATIVE WANTED in New York and Philadelphia areas by established eastern precision investment casting house producing non-ferrous castings. Prefer young, energetic man with engineering background and with allied lines. Established accounts in area will be turned over to qualified man. Please send all information in first letter, including lines carried, territory covered, selling and engineering experience. Write Box No. 1155 PRECISION METAL MOLDING magazine.

DIE CASTING ACCOUNT WANTED — Established manufacturer's agent wants to represent die caster capable of making large (up to 5 lbs. in cluminum) aluminum and/or zinc die castings on either exclusive or non-exclusive basis. Write Box No. 1255 PRECISION METAL MOLDING magazine.

FOR SALE — 400 ton Cleveland Automatic cold chamber die casting machine with complete electrical equipment and hydraulic system with Lindoln type packing. Saginaw Bay Industries; Box 752; Bay City, Michigan or telephone Bay City, Michigan 21589.

MACHINE DESIGNERS — Die Casting Equipment—As a result of an expansion program of large Midwestern Machine Tool Manufacturer, engineers, experienced in die casting machine design and development, are needed. Top job available for right man. Write Box 1355 PRECISION METAL MOLDING magazine.

SALES ENGINEERS—Die Casting Equipment—Large established manufacturer of die casting machinery wants sales engineers experienced in die casting process and equipment. Write Box 1455 PRECISION METAL MOLDING magazine.

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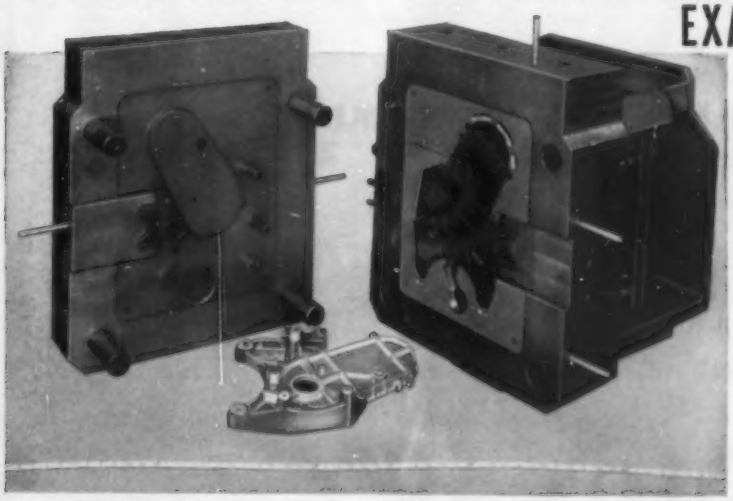

A mere glance will show that adequate equipment was required to make the die pictured at the left. Also, into its design and construction went a know-how growing out of a 21-year background. Cuyahoga places at your command a complete engineering service in die design.

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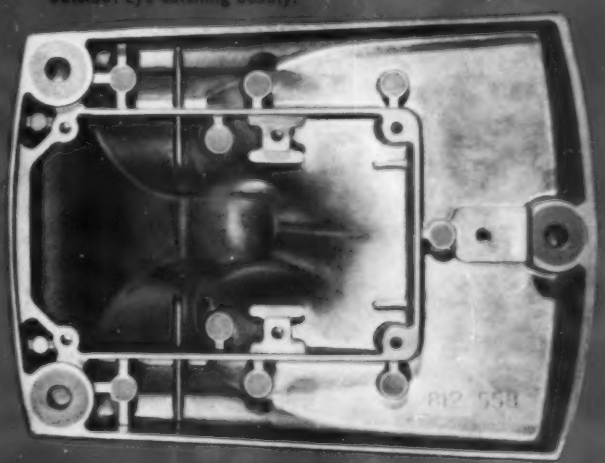

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6. Lighter die-cast bases provide a freight charge saving in the shipment of finished goods.
7. Lighter die-cast bases make stock room work easier—save time.
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